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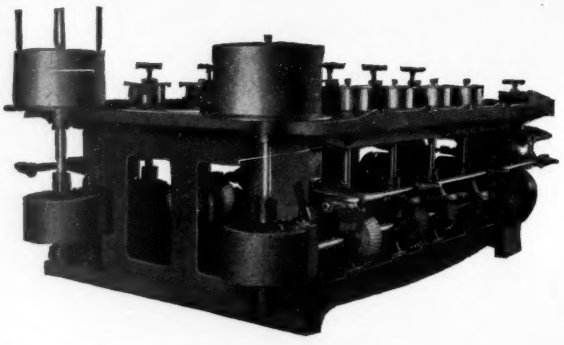

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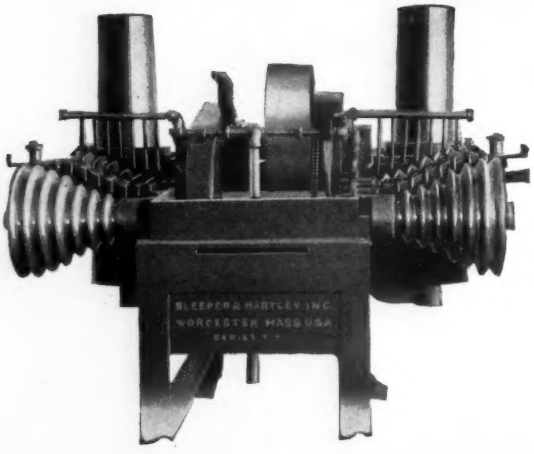

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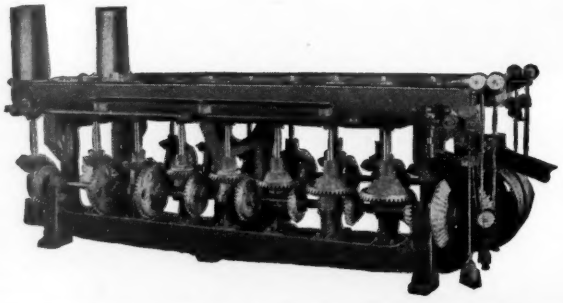

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING.

Vol. 6 November 1931 No. 11

Official Publication of The Wire Association

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 6 NOVEMBER, 1931 No. 11

Rust Protection of Wire Products With Cadmium

By C. M. Hoff,
Chemical Engineer
Grasselli Chemical Co., Cleveland, Ohio

A paper read before the Wire Association describing the properties of cadmium, methods of application to wire products, equipment required and recent developments in connection with inhibitors.

TAKING an impurity out of zinc and making this impurity useful instead of undesirable has been, in brief, the history of the development of cadmium.

As an impurity in zinc to be used in hot zincing, cadmium above certain small percentages, is objectionable because it produces undesirable physical characteristics in the zinc coating. (Note 1.) Alone, however, cadmium has desirable physical properties and in addition, many chemical characteristics which render it valuable for the rustprotection of iron and steel.

It is the purpose of this paper to outline briefly the physical and chemical properties of cadmium, indicate how it functions as a rustprotective agent, describe its methods of application and review the various products on which cadmium is and may advantageously be used for rustprotection.

Properties of Cadmium

CADMIUM is a white ductile metal having physical properties quite similar to tin and chemical properties more like those of zinc. It is slightly softer than zinc but harder than tin and can be rolled into sheets or drawn into wire. Its relatively low melting point 320.09° C. (609.6° F.) enables it to be easily melted and cast. It is easily buffed to a bright luster comparable to silver but like most metals does not retain this lustre when exposed to moist atmosphere. (Note 1)

C. M. Hoff, Chemical Engineer
Member Wire Association

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THE chemical properties of cadmium more closely resemble those of zinc than of any other metal. It is fairly soluble in most acids but insoluble in almost all alkalies. It is not amphoteric in character as is zinc but like zinc, silver and gold, its salts form double cyanides with alkali cyanides which are soluble. This property is employed in the process of its edectro-deposition. Cadmium is relatively inert toward the action of the oxygen and moisture of the atmosphere. In the electromotive force series of metals cadmium is electronegative to iron, that is, it acts toward iron the same way as zinc and protects it electri-chemically. (Note 2).

The properties of cadmium can probably best be described by a comparison with zinc and for the purpose of completeness the properties both of cadmium and zinc are listed as follows:

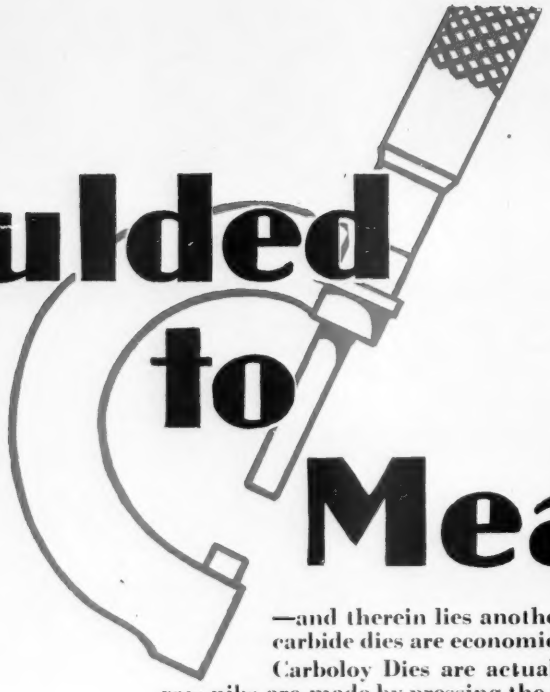
Cadmium

Atomic weight, 112.409; Baxter and Wilson, J. Am. Chem. Soc. (1921.)

Valency, 2.

Electrochemical equiv., 0.5824 mg. per coulomb, or 2,096 g. per amp. hr.

Moulded to Measure



—and therein lies another reason why Carboloy cemented carbide dies are economical for the user.

Carboloy Dies are actually "moulded to measure." The raw nibs are made by pressing the powdered metal into steel moulds with steel plungers which *form the shape of the whole to be finished.* After moulding, only a few thousandths must be removed to finish the die to the starting size required.

To the Carboloy Die user, the advantages of this advanced technique are twofold:

1. Uniformity of die shape is assured. All types of dies can be exactly reproduced from the original moulds whenever, and in whatever quantity, desired.
2. Rough nibs in cases may be purchased at a considerable saving and finished by your die man. The technique required is the same as that used for recutting or reworking dies on standard service equipment.

Carboloy raw nibs are manufactured in the United States. The user immediately benefits by each new development in manufacturing technique.

Logical shortcuts to economy such as these are contributing to the general savings being effected by Carboloy Dies in the drawing and extrusion field.

Our representative can outline many interesting and valuable facts about lower conversion costs —less scrap, fewer rejections—and improved quality obtained with Carboloy Dies.

May we have him call? Without obligation, of course.

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Specific gravity (cast), 8.604; Strohmeyer Schweigg Journ.

Specific gravity (hammered), 8.694; Strohmeyer Schweigg Journ.

Specific heat, 0.0576; Dulong and Petit, Ingalls, p. 580.

Specific resistance 6.2-7.0 microhms per cmc.

Latent heat of fusion, 13.00 cal.; Budgeon.

Latent heat of vaporization, 251.00 cal.; Budgeon.

Melting point 320° C.; Journ. Franklin Inst.; 174,227.

Boiling point, 785° C.; Ruff and Bergdahl, Zeit. An. Chem. (1919).

Tensile strength, 13,660 lbs. per sq. in. (4,667 kg. per sq. cm.); Hofman.

Elongation per cent, 44.0 at above breaking point; Hofman.

Hardness (annealed), 21.3-25.5 Brinell Scale.

Coefficient of expansion, 0.0000-306 linear, 0°-100° C.; Budgeon.

Zinc

Atomic weight, 65.37; Olsen.

Valency, 2.

Electrochemical equivalent, 0.3388 mg. per coulomb, or 1.2194 g. per amp. hr.; Gore.

Specific gravity (cast) 7.142; average value.

Specific gravity (rolled), 7.25; Ingalls.

Specific heat, 0.09356; Olsen.

Specific resistance, 5.56-6.04 microhms per cmc.; Hofman.

Latent heat of fusion, 22.60 calories; Hofman.

Latent heat of vaporization, 446.00 calories; Hofman.

Melting point, 419.4° C.; Olsen.

Boiling point, 419.4° C. Olsen.

Tensile strength, 3-17,000 lb. per sq. in.; Liddell.

Hardness (annealed), 25.0-30.0 Brinell Scale.

Coefficient of expansion (linear), 0.00002918; Olsen.

Corrosion Preventive Methods

THE corrosion of iron and steel may be prevented by two methods which we may classify as **mechanical** and **electrochemical.**

The function of a **mechanical** method of protection is to prevent corrosive agents from coming in contact with the iron and steel and its efficiency depends upon the thoroughness with which the protective medium covers the iron or steel and upon the permanency and durability of the coating.

The **electrochemical** method of protection consists of placing in contact with or covering as completely as possible the iron and steel with an element or compound which will by virtue of its electrochemical properties be corroded in preference to the iron and steel, if corrosive conditions exist.

Theoretically considered, there could be no better rust protective agent than a metal inert to all corrosive conditions, resistant to mechanical shock or abrasion, which could be deposited in a perfect, non-porous, continuous form. Such a coating would provide perfect mechanical protection and would not itself be corroded or abraded. There has, however, been no process or material discovered that will possess all these qualities and it has been found necessary to depend upon metals or materials which will provide electrochemical protection.

As has been shown, cadmium provides electrochemical protection in a manner similar to zinc. It also provides good mechanical protection, for although it is soft and not especially resistant to abrasion it can be deposited in a relatively non-porous form which is resistant to mechanical shock and cannot be chipped or peeled and is perfectly adherent.

The properties of cadmium which enable it to function as an electrochemical protection, and the development of means of depositing it in a form providing the maximum mechanical protection, account to a great extent for its successful use as a rust-protection for iron and steel products.

Methods of Application

CADMIUM can be applied to iron and steel by several methods, the most important of which is the electrolytic method wherein cadmium is electrodeposited on the iron or steel products using a suitable electrolyte and an external source of direct current. This method is the commonly known cadmium plating process by which most commercial work is done, and in which the amount of cadmium to be deposited can be controlled at will by varying the time and current density.

Another electrochemical method is one similar to tinning with "tin salts" in which a bath is so constituted that when some metal articles are placed therein under the proper conditions a small amount of cadmium will be deposited therein, withou the use of external source of electrical current.

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CADMIUM can also be applied to iron and steel articles by dipping them in molten cadmium with the use of a suitable flux in a manner similar to hot zincing. Due to difficulties of operation and its cost, very little work is done by such processes except for special applications.

Metal spraying processes such as the Schoop Process can be used for applying cadmium, but due to its cost this method does not find extensive application, its use being confined to special work where plating processes are impractical and is valuable in coating nonmetallic articles which would not act as electrical conductors.

Of the foregoing methods of the application of cadmium the electrolytic method or plating, as it is commonly known, is by far the most important and most extensively used, due principally to the fact that by this method, cadmium can be deposited in a very efficient form and the thickness of deposits controlled at will.

Although it has been known for a long time that cadmium could be deposited by the electric current from solutions of its various salts (Note 3) little research was conducted toward perfecting a method for plating it and for developing its commercial application until the last ten years. (Note 4). During this period, however, companies and individu-

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A copy of the **Annual Buyers' Guide and Year Book of the Wire Association.**

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(*Firm, Organization or Individual applicant*)

Address .....

Nature of Business .....

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Address of Organization .....

Applicant's Title or Occupation .....

als interested in the production and application of this metal have conducted rather intensive research work (Note 5) both on the development of processes for its application and on a thorough investigation of the chemical and physical properties of this metal as affecting its use and application.

Most of the development work centered around the use of sodium cadmium cyanide electrolytes for, early in the work as well as up to the present time, these solutions afforded the most desirable characteristics of any of the solutions.

The most recent and comprehensive published work on these developments (Note 6) summarizes the results of work directed toward the improvements of these solutions. Many characteristics of the process must be taken into consideration, chief of which are the following:

1. Throwing Power

IT is a characteristic of all plating solutions to deposit more metal on parts of the cathode that are near the anode, primarily because the resistance of this solution is lower at that point and more current passes. Very deeply recessed parts and (severely) shielded portions receive a proportionally thinner deposit. A solution or process of perfect throwing power would be one that would cover all parts with the same thickness of deposit. This is a theoretical condition and one that has not been attained. It has been the aim of research, however, to improve the throwing power as much as possible and great improvements have been effected as a result.

2. Conductivity

IT is desirable that a solution be of low resistance in order that the temperature of the solution is not unnecessarily elevated which would cause deterioration of the chemicals and equipment used.

3. Current Efficiency

A high metal current efficiency is essential, for, if the current is not used in transporting the metal ion it results in electrolytically decomposing the solution with resultant loss of chemicals as well as loss of electrical energy.

4. Current Density

THIS is usually expressed in terms of amperes per square foot of either anode or cathode surface and it is obvious that the higher the current density that can be used, maintaining other desirable qualities, the shorter the plating time and the greater the production per unit of equipment.

5. Character of Deposit

IT is essential for appearance and rustprotection that the metal deposited be bright, free from pores, dense, ductile and adherent.

6. Character of Solutions

IT is desirable that the solution be as near self maintaining as possible, namely, that the current removes from the anode the same quantity of metal deposited on the cathode allowing the amount in the electrolyte to remain constant, and that the ingredients of the solution are not consumed or altered. The cost of the ingredients of the solution should be as low as possible, for there is always a certain mechanical loss of the electrolyte due to the fact that parts plated with it are wet with the solution when removed. This loss of course varies greatly with the character of the product plated.

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THE foregoing are some of the factors taken into consideration in the research work on this subject and the effect on these factors of varying the kind and amounts of each ingredient of the electrolyte has been thoroughly studied with the result that the best cadmium plating processes available produce first of all brilliant dense and ductile deposits of pure cadmium, operate at very high current densities and current efficiencies, possess high throwing power and employ electrolytes of unusual stability and self maintaining qualities.

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Process Specifications

THE following are the specifications of an efficient process:

Deposit: Pure cadmium, bright, dense, ductile and adherent.

Anodes: Pure cadmium. No insoluble material comprising active anode surface.

Cathode Current Density: Range bright deposit 10-50 amperes per square foot.

Cathode Current Efficiency: 95% at 30 amperes per square foot and equal to anode current efficiency.

Throwing Power: Having cell ratio, 5:1, 40%.

Specific resistance of electrolyte. 5 ohms per cm. cube.

Production: Deposit of .0003" of cadmium to be obtained in six minutes plating time at a current density of 30 amperes per square foot.

Cleaning and Pickling

ALL iron and steel as well as other metal products must be properly cleaned in order that the metal plated thereon possesses the proper appearance, adherence and protective qualities. This cleaning, of course, should vary with the condition of the surface of the work. Sand and scale on castings can best be removed by tumbling or sandblasting. Rust, oxide or light scale should be removed by acid pickling; grease or oil by alkaline saponifying or emulsifying agents. Unless unusual conditions exist the accepted procedure for the complete operation is as follows:

1. Alkaline cleaning with or without the use of direct current for the removal of grease or oil.

2. Rinse in water to remove the alkaline cleaner solution.

3. Pickling in acid to remove the oxide, rust or scale.

4. Rinse in water to remove the acid from pickling bath.

5. Plating for the required time in the cadmium plating solution.

6. Rinse in water to remove the plating solution.

7. Rinse in hot water for drying.

8. Drying by air, heat, centrifuging or sawdust.

Plating Equipment

THE type of equipment to be used in the plating operation will vary of course depending upon

the type of work to be plated and upon the facilities of shop methods for handling material.

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THE simplest procedure is known as still plating and requires a container or tank for the solution, anode bus bars for supporting and carrying the current to the anodes, and a cathode bus bar from which the product is suspended in the electrolyte by means of wires or racks. This type of equipment or procedure is used for relatively large pieces or products of such a type that would be injured by tumbling or rolling.

If the production of this type of work is quite large it becomes more economical to employ a moving cathode support or semi-automatic conveyor, as the equipment is called, in which the parts to be plated are suspended on a conveyor which carries them usually to the other end of the tank and back, the plating taking place during this travel. The equipment may be timed so that the products remain in the bath just the correct time in one circuit, which eliminates a variable factor in plating and permits the work to be loaded and unloaded from the same point thus saving considerable labor. The preliminary cleaning and the subsequent washing and drying operations are manual.

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STILL larger production warrants the use of more mechanical equipment and the type of equipment known as a "full automatic" is used. In this all the cleaning, pickling, rinsing, plating and drying operations are conducted mechanically, the various tanks being placed in line and the work to be plated conveyed from one to the other and held in each solution the proper time entirely by mechanical means. This method of handling, of course, eliminates any variables in the time of each treatment and requires the minimum of labor for its operation, it simply being necessary to place the work on the conveyor and remove it after it has been completely processed. Careful study of the cleaning methods to be used should be made before the equipment is designed, for the work usually travels at the same speed throughout, the time of each operation being regulated by the length of the tank, and all operations should be well synchronized.

Plating Equipment

FOR the plating of small parts, mechanical equipment, commonly called "barrel platers", are used, the principle employed being the tumbling or rolling of a considerable quantity of small parts in the plating solution in contact with the cathode so that during the plating period all pieces are brought into position where they will receive approximately the same deposit. The cadmium anodes are, of course, suspended in the solution but held out of contact with the product by virtue of their being above the work or by being separated from it by a screen of non-conductive material, which, however, allows the current to pass through small openings therein but which retains the parts to be plated.

Nuts, bolts and screws constitute a large portion of the products plated by barrel platers.

Wire, wire cloth, chains and other products that are manufactured in pieces of considerable length require a different type of equipment. The process is quite similar to the "full automatic" process in that it is continuous and the product passes through each treating tank in succession, traveling at a given rate but is modified by the fact that the product itself is the conveyor or the moving part and can be unrolled or unreeled at one end and rolled up or reeled as a finished product.

Two types of equipment are used for this purpose, one a simple long tank with the wire, for example, running the entire length with suitable contacts for electrical connections and with anodes placed above and below or beside the wire and the other a shorter deeper tank in which the wire is made to travel the height of the tank several times by means of pulleys or rolls in the bottom and top of the tank. The same procedure is often followed in the cleaning and rinsing tanks, the advantage of the latter method of handling being a great saving in floor space.

Types of Wire Products Processed

ONE of the advantages of cadmium is the fact that by its use one secures both rustprotection and an attractive finish. Many users of wire are purchasing it plated with cadmium for this reason. It quite closely matches polished aluminum and finds a valuable application in this connection. Wire for brush manufacture, stitch wire, and flat wire for electrical work are among the commercial commodities supplied with this finish. Such wire is usually cadmium plated to meet the user's specifications by a continuous process such as that already described.

Drawing Properties of Cadmium Plated Wire

ONE valuable and interesting property of cadmium plated wire is that it can be drawn to smaller sizes without the loss of any of the protective metal. The ductility and lubricative properties of cadmium, when properly deposited, facilitate the drawing operations and the resultant product has a brilliant silvery finish.

Furthermore, cadmium plated flat wire or sheet can be cold rolled to several times its original area with perfect adherence and uniform thickness of the metal covering.

Rust Protection

THE rustprotection of piano wire was one of the earlier applications of cadmium on wire products. (Note 7). The normal increase in the use of cadmium for this purpose has in effect been substituted by its increased use in radio equipment.

It is difficult to rustproof many types of closely wound steel wire springs and in such cases it is advantageous to plate the spring

steel wire and wind or form the spring afterward This method provides uniform rustprotection on all contacting, exterior or interior surfaces.

Nuts, Bolts, Screws

EACH process or each material used for rustprotection has certain applications where it is especially suitable. One example of this is the rustprotection of screws, nuts and bolts with cadmium.

First of all, a sufficient degree of rustprotection can be obtained without the deposited metal filling the threads to such an extent as to interfere with the fit of the nut on the bolt.

Further the appearance of the plated product is very pleasing and effective.

This type of product can be very economically plated with cadmium for its character ordinarily is such that it can very economically be handled in bulk and plated in large batches in barrel platers.

Ductility

THE ductility of this metal, likewise is an advantage for where a pressure tight fit is desired, for example a spark plug or sealing plug for drums or gas cylinders, pipe fitting, etc., the metal will flow sufficiently to allow a tight seal to be easily made. This property of cadmium also enables parts to be readily unscrewed and disassembled and further, for example, in the care of the abrasion of wrenches on nuts, the cadmium may be marred to some extent but does not chip off or peel.

Nearly all of this type of product is plated in barrel platers, the exceedingly large sizes being the exception, and is usually plated and handled in batches or loads of over a hundred pounds at a time which greatly reduces labor costs.

Owing to the exceedingly rapid rate at which modern plating methods deposit cadmium no trouble is experienced in quickly building up the necessary thickness of deposit, whereas in plating with some other metals the rate of tumbling is necessarily rapid to insure uniformity of deposit, due to relatively low throwing power, and the mechanical abrasion of the tumbling parts so severe that the deposit is worn off almost as rapidly as it is deposited.

Bright Finish

CONTRARY to what is often assumed the brightness of such products plated in a barrel plater using the best methods is not due to the burnishing action of the moving parts but due to the fact that the deposits from the best cadmium solutions are normally bright and the metal is deposited in this form so rapidly that it is bright in spite of the tumbling operations which in most cases would dull it.

The appearance of these products, the degree of rust protection obtained, the ductility of the deposit and the low cost of processing them render them most adaptable to cadmium plating.

Screen and Wire Cloth

THE application of cadmium on screen or wire cloth of small mesh has met with some paradoxical results. Theoretically no cadmium would be deposited on the point where the wires cross and touch. However, exposure tests have shown this point to be the last to rust. We do not attempt to explain it, we simply present the fact.

The well known salt-spray test has shown cadmium to be many times superior to zinc for rustprotection under such conditions. On this basis it would be predicted that cadmium plated screen would find extensive application along our sea coasts.

In many cases the choice of the metal protection to be used is a question of cost of production and this usually is a case of balancing the higher cost of the cadmium metal used against the lower overhead and labor costs due to more rapid rate of deposition and increase of production.

Builders, Hardware

MANY of the finishes on builders' hardware have been in the past considered essentially from the standpoint of appearance and color of finish. Many of the metals used for providing colored finishes did not provide much rustprotection. Recently, however, more attention has been given to rustprotection, as a result of which many manufacturers are first providing rust protection by cadmium plating and secondly plating other metals on the cadmium for the color effects.

Many concealed parts, for example, hinge springs, especially are plated with cadmium not only for rustprotection but because of its lubricative value squeaking is practically eliminated.

Miscellaneous Products

THERE are thousands of different products rustprotected by cadmium such for example as hooks, screw eyes, nails, tacks, cork screws, hose clamps, bottle racks, buckles, radio parts, electrical apparatus, etc., which are made from wire or wire products. Appearance plays a large part in selecting cadmium as the finish. It is often necessary to match the color of chromium, stainless steel or polished aluminum; this cadmium does quite satisfactorily; a bright cadmium plated bolt head blends nicely with the chromium plated part it fastens on an automobile, the cadmium plated screw or ferrule looks like the rest of the polished aluminum vacuum cleaner.

Many of the switch board panel manufacturers are covering not only the iron and steel parts but all the metal parts with cadmium, the beautiful white and black finish providing not only desirable protection but a new mode in appearance. On the basis of equal merit, appearance usually determines the customer's choice.

Airplane Parts

ON very few products are the tolerances so limited and the specifications so exacting as they are on airplanes. Because cadmium can be quickly deposited, its thickness predetermined and easily tested it is almost universally specified for rustprotecting iron and steel airplane parts.

On all planes used for marine work cadmium is still more important, owing to its resistance to salt water corrosion. In addition the fact that iron and steel parts can be plated with cadmium without changing their physical characteristics, and that the minimum of metal will provide the maximum of protection still further justifies the specification of cadmium for this purpose. (Note 8).

Among the most important parts protected by cadmium are the stream line wires used for wing and fusilage assembly.

Springs and Spring Steel

THERE has been in the past certain difficulties in cleaning and electroplating of spring steel of any type due to the fact that the prodct invariably becomes brittle and usually worthless for the purpose intended. This condition was caused by the adsorption of hydrogen both in the cleaning operations and in the plating. It has been necessary in many cases to bake the plated product for a considerable time to eliminate this brittleness in order that the product could be used.

Obviously this trouble could be avoided if in the processes of cleaning and plating conditions were created so that no hydrogen was formed. The research work in cadmium plating indicated that the metal current efficiency could be increased to almost one hundred per cent and it is obvious that if all the current of a plating process is used in depositing metal that no hydrogen is formed, and that once the cause of embrittlement is removed no such trouble should be experienced. Then employing the high current efficiencies of the cadmium plating process developed in our research laboratorieh, we were able to deposit the desired thickness of cadmium of this type of product and retain the same physical condition which the tempered steel possessed before plating.

The problem was at this point but half solved; it was still necessary to eliminate the adsorption of hydrogen in the pickling operations for in the case of most spring steel it is necessary to remove considerable oxide by means of acid, and this operation results in the adsorption of sufficient hydrogen to cause severe embrittlement. Attention was given to studying the effect of inhibitors and the recent research work of our laboratories (Note 9) on this subject again indicated the proper procedure to follow, with the result that we were soon able to pickle spring steel products without any appreciable adsorption of hydrogen and co-existant embrittlement.

Inhibitor Developments

IT might be in order at this point inasmuch as the subject is so closely inter-related to outline some of the recent developments in connection with inhibitors. Considered from a theoretical standpoint the ideal condition for pickling is one which will permit all the oxide, scale or rust to be quickly and completely removed without any action on the metal itself. An inhibitor might be defined as a substance which will permit rapid solution of the various metal oxides by an acid and retard the action of the acid on the metal itself.

The theory of the action of inhibitors is still somewhat speculative and we are not interested in that so much as we are in the results obtained, and it is gratifying to note that as a result of extensive research work inhibitors are available that will retard the action of acid on steel to 5% of its normal rate (Note 10) while at the same time permitting the solution of the oxides, scale and rust to proceed at approximately the normal rate. In other words, they are ninety-five per cent efficient.

While by the use of inhibitors for general pickling purposes we accomplish a considerable saving in steel, prolong the useful life of the pickle, provide better working conditions, secure a better surface of the metal for subsequent treatment and enjoy other advantages, we are principally concerned in so far as this discussion is concerned with the fact that if we eliminate 95% of the hydrogen formation and thus decrease to a very great extent the adsorption of hydrogen.

It naturally follows that if we prevent the formation of hydrogen at the surface of tempered steel during the pickling that we prevent this source of acid brittleness and this is one of the very valuable uses of inhibitors. By the use of the **proper amounts of some inhibitors,** together with the use of the **right kind and strengths of acids,** acid embrittlement in pickling can be **almost entirely eliminated.**

Then if we combine this method of pickling, with a cadmium plating process of approximately 100% cathode metal current efficiency we can obtain a product which is entirely satisfactory in so far as all physical characteristics are concerned.

This is an important development in the plating field as it enables the manufacturers of spring steel products to finish and provide rustprotection for this product equal to and at the same cost as other iron and steel products.

Testing

THE testing of deposits of cadmium to determine the protection provided has been a difficult problem. Many tests have been proposed and used, such as the Preece test, acetic acid peroxide test, salt spray test, hydrogen evolution and others. It is not too conservative to state that none of these tests will accurately forecast the life of the product under its conditions of use before it rusts. The salt spray test commonly used is open to the objection that it requires too long a time to complete the test and furthermore that it is a measure of the life of the plate only under a special condition. Other tests show the uniformity of the deposit and others indicate the thickness of the plate.

The latter method, that is, one that will accurately show the thickness of the deposit is at present undoubtedly the most satisfactory

(Please turn to page 447)

The Manufacture of Tungsten Carbide Dies

A description of the production methods of the Carboloy Co., Inc. An outline of the simple plant equipment required for mills who purchase rough nibs and do their own finishing ▼ ▼ ▼ ▼ ▼

THE Carboloy Company, Inc., has recently added a Die Manufacturing Department to their tool factory at Detroit.

Their factories for finishing dies will be maintained to serve those users of dies who find it most economical to buy the finished die.

For the large users of cemented carbide dies who have found it necessary and desirable to rework the dies in their own plant, these factories are available as training schools for the customer's die room men. Firms having established reworking equipment in their die shops, have found that they can make an additional saving in the original investment in cost of dies by purchasing a rough nib mounted in a case and completely finishing the die at the starting size required. The technique required in so doing is exactly the same as that required for recutting or reworking the dies through the several hole sizes in the range of the nib purchased and a description of the process is given herewith.

Simple Methods Used In Manufacture

FROM the raw nib through to the finished die the program is one of simplicity and efficiency. This is obtained by the use of standard equipment in manufacturing, and by following simple methods of manufacture. Because these are, after all, fundamental shop methods, the simplicity of manufacturing these dies on standard equipment can be duplicated in the plant of the user at a low cost. The result is a saving accomplished by purchasing rough nibs mounted in casings rather than finished dies.

The complete manufacture of cemented carbide dies falls into three general divisions: first, the making of the raw nib, second, the mounting of the raw nib in a casing; and third, the finishing into a completed die of the rough nib mounted in a casing.

Making Raw Nibs

CEMENTED carbide raw nibs are made by pressing the powdered metal into steel molds with steel plungers which form the rough shape of the hole which is to be finished. By this method the shape of the finished die is formed in the rough nib by a simple mechanical operation and only a small amount of material has to be removed to obtain the specified shape and size in the finished die. The economy of this method is quite apparent as the amount of hardened Carboloy to be removed has been reduced to a minimum.

The flexibility of this method of producing raw nibs permits the manufacture of any shape of rough nib designed with a minimum amount of stock to be removed in finishing. In addition, all improvements in these cemented carbides are immediately available for the user because of the close connection between manufacturing procedure and ultimate use of the finished product.

Further, a better product results from this method of manufacturing. Pressing the larger nibs with the rough hole allows the pressure to be applied more evenly throughout the nib and a more uniform heating and shrinking during the final hardening operation.

Mounting Rough Nib In Casing

THE second step in the manufacturing program is the mounting of the rough nib in a casing. The smaller nibs are fitted and copper-brazed into casings to facilitate handling in the mill. This method of mounting provides adequate support for the strain to which the smaller nibs are subjected in drawing work. The slight taper on the outside of the rough nib, which facilitates the removal of the nib from the mold after pressing, is not removed in brazing the smaller nibs in cases.

Larger nibs are mounted in hardened steel cases, not only to facilitate handling, but also to support and strengthen the nib. The nibs are ground (See Fig. 1) on the outside diameter concentric with the hole and square with the back face and are then pressed into hardened steel casings or have hardened steel casings shrunk around the nib. Shrinking a hardened casing around the ground nib places the nib in compression.

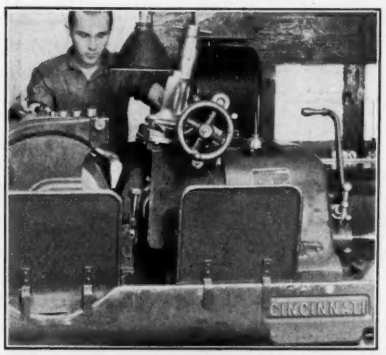

Fig. 1—The nibs are ground on the O. D., concentric with the hole and square with the back face. ✦ ✦ ✦ ✦ ✦

THE amount of load applied to the nib in mounting is care-

fully calculated and the amount of shrinkage allowed is determined from the loading to be applied to the nib. In this manner it is possible to load the nib to the maximum which it will stand. By this means the nib is in compression when the drawing load is applied and the drawing load is transmitted directly to the casing until the load exceeds the preloading. Any load beyond the preloading is carried by the nib and the casing.

It is good practice to load the outside of the nib as high as 60,000 lbs. per square inch, and loadings as high as 150,000 lbs. per square inch have been applied with no apparent ill effects. The compression load on the inside of the nib is greater than the load applied to the outside diameter, but in cases where the high loading was used, no evidence of failure due to this high internal stress was noticed.

After the nib is shrunk in the casing, the casing is finished so that the outside diameter and faces are concentric and square with the axis of the nib. The rough nib has now been mounted in a casing and is ready for finishing.

The Final Operation—Finishing

PRACTICALLY all of the work in the final finishing operation is done on modern machine tools; the amount of hand work necessary is a small percentage of the time required to finish a die from the rough nib, consequently the personal skill of the operator is not the determining factor in the final product.

There are several manufacturing techniques applicable to the finishing of these dies. In order to take full advantage of modern machine tools, one method of manufacture for dies ¼" and smaller is followed and another method for dies over ¼".

Lapping Approach Angle of Dies up to 1-4"

DIES ¼" and smaller are usually finished by first lapping the approach angle to the diameter required to finish the die with the specified size, land or bearing length, and back relief. Since the approach angle is known, it is a simple calculation to obtain the diameter of the frustrum of the cone required to finish into the die specified. Charts and tables are available from which this information may be quickly and easily read.

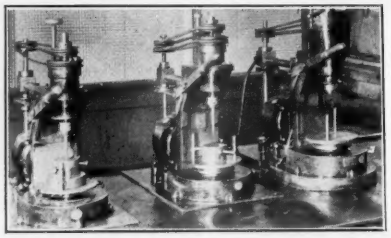

Fig. 2—Machines used to lap approach angles of dies up to ¼" diameter.

The lapping machines shown in Fig. 2 are an example of the machine tools available for this work. These tools will increase the diameter of a hole at the rate of approximately .001" per minute. It is necessary to change the steel laps every three to five minutes in order to hold the angle when using Carborundum powder. This is accomplished by a simple operation of loosening the chuck to allow the used lap to drop out, slipping the new lap into place, and tightening the chuck. A skin cut is taken on the used lap to restore the angle, so that the lapping pins may be used over and over again. One man can operate several of these lapping machines or can perform other operations while operating one machine.

This lapping work has been done before finishing the rough casing. Only the back face of the case has been faced before lapping, and this is done because there is a tendency for the nib not to seat properly in brazing, thus making it necessary to face the back of the casing square with the back face of the nib. After the rough nib has been lapped out to the proper diameter, the entire casing is cleaned up to the proper dimensions so that the outside diameter and the faces are concentric and square with the axis of the die.

The next operation is the machining of the front relief radius which is speedily done with a cheap diamond tool used in a radius fixture fitted to a standard lathe.

Lapping Approach Angle and Front Relief Radius

THE rough lapped approach angle and the machined front relief radius are next polished to a smooth, flat finish with diamond powder of various grades. This powder is mixed with olive oil and the mixture applied with a soft stick. Very little material is removed in this operation and the time and diamond powder mixture required is slight. The die is chucked in a standard bench lathe with a spindle speed of 1600 to 2000 R. P. M. which serves very well on this operation. On dies ove .040" diameter it is possible to utilize a flexible shaft and revolving lap to cut down the time required for this operation. The lap speed for this work should be from 4000—6000 R. P. M. (Fig. 3) shows a unit which is complete and will allow the operator to speedily finish dies. The flexible shaft is clearly shown in this picture.

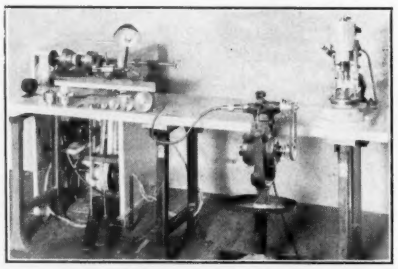

Fig. 3—A complete unit which permits operator to speedily finish dies.

Final Sizing and Polishing

THE die now needs only the final sizing and polishing operation to be complete. The land or bearing is lapped to size by using solid laps and diamond powder while the die is held in the standard lathe. A small diamond tool very effectively relieves the back with a small radius, and a final polishing with a fine grade of diamond powder used with an orange-wood stick completes the die.

Two Methods for Dies Over 1-4"

TWO methods of manufacturing are available for making dies over ¼" in size. One method employs a standard internal grinder and the other uses diamond boring tools and laps on a standard tool room lathe. Both methods produce satisfactory results. Each method is practically a complete machine tool operation, the amount of hand work required being very slight.

The first method described is that using standard internal grinders. The rough nib is first mounted in a casing, which is usually a hardened casing for dies of this size. The rough grinding of the approach and bearing is done with diamond wheels.

The small abrasive wheels available for use on internal grinders for this type of work are not very effective. Diamond wheels have been developed which are not expensive and which remove the cemented carbide quickly and economically.

The wheels used in doing the rough grinding are roughing wheels. Finishing wheels have also been developed which give a much better surface and a finish which has proved to be satisfactory for brass rod and steel with .50 carbon or more in some instances.

The final finish for drawing almost any metal can be obtained without removing the die from the machine after rough grinding with the roughing wheels. This is accomplished by using revolving copper laps held in the grinding spindle. Fig. 4 shows an internal grinding machine which such a lap in place.

After the die has been rough ground, finished with a finishing wheel, or finish lapped with a copper lap—all of which has been done on a standard internal grinding machine—the final operation is to polish the front relief radius and the back relief radius by using a lap driven by a flexible shaft. The front relief radius is pressed in the rough nib, and needs merely to be polished. The back relief is rough nibs mounted in casings raground at a definite angle on the internal grinding machine, and is rounded and polished with a lap driven by a flexible shaft. Laps driven by a flexible shaft are also used to blend the approach into the land or bearing when a profile grinder is not available.

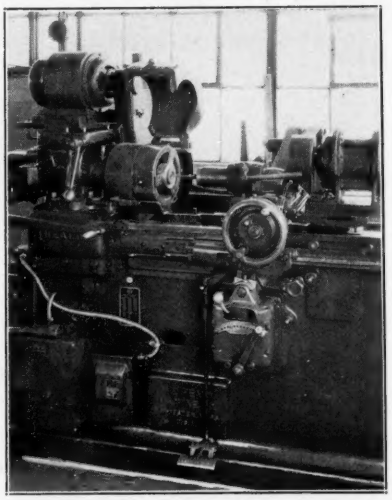

Fig. 4—The use of an internal grinder is another method of finishing dies. ✦ ✦ ✦

An Alternate Method

THE second method of manufacture is the use of diamond boring tools and laps on a standard tool room lathe. A good tool room lathe equipped with diamond boring tools and having a spindle free from bearing play will serve nearly as well as an internal grinder. A diamond tool will cut cemented carbides quite easily if the spindle is tight and the diamond tool is held in a rigid shank and tool post. The quill-type holder held in a solid block fastened to the compound is better than using the standard tool post in a lathe.

As described above with reference to the internal grinder, practically the same work is done first with the diamond tool equipped lathe—the roughing out of the approach angle and bearing.

The best tool life obtained to date has been at a surface speed of about 100 ft. per minute, .003-004" depth of cut, and .0008-.0012" feed per revolution. The tool should be carefully set .002" above center to give best results. A good test of satisfactory results is to observe the chips coming from the boring operation. These should closely resemble cast iron chips even to the small curl. Lapped tools give very good service, but we have found that good service can be obtained from cleaved stones properly set. The finish obtained from the roughing work with the boring tool is not good enough for ordinary drawing, but has been used on ripping with some success. The die is usually lapped to size after boring.

This lapping work is done first on the roughed out approach by using laps in the flexible shaft. The front relief radius is polished in the same operation.

The bearing is lapped to size by the use of solid or split laps, and a mixture of diamond powder and olive oil. The back relief radius is easily accomplished by using a lap driven by the flexible shaft.

The simplicity and efficiency of this manufacturing program may be summarized in two facts of prime importance:

1—Simple methods of manufacture are used on standard equipment throughout the manufacturing process thereby reducing investment and eliminating personal skill as a determining factor in the finished product.

2—The flexibility of the method of producing raw nibs makes available nibs of superior quality with a minimum amount of stock to be removed in finishing into a completed die.

The importance of these two facts to the user of cemented carbide dies cannot be over-emphasized. Because of the simplicity of manufacturing cemented carbide dies on standard equipment, the procedure can be duplicated in the plant of the user at a low cost. Because of this duplication a saving immediately results by the customer's ability to purchase for use rough nibs mounted in casings rather than finished dies.

Digest of Recent Research Papers

By Kenneth B. Lewis

Wire Mill Engineer, Morgan Construction Co., Worcester, Mass.

At the fourth Annual Meeting of the Institute of Metals of Great Britain which took place in Zurich, September 13th, a number of research papers of interest to the wire industry were presented.

A digest of these papers is given herewith together with digests of wire research articles appearing in foreign publications. ▼ ▼ ▼ ▼ ▼

Behavior of a Composite Rod

(Experiments in Wire-Drawing. Part I)

by W. E. Alkins, M. Sc. and W. Cartwright, O. B. E., M. Sc.,

A Digest of a Paper Presented Before the British Institute of Metals

THE experiment described in this extremely interesting paper goes far toward establishing some fundamental facts in wire drawing. The authors built up composite bars of copper by starting with quarter inch rods and drawing onto them successively a number of copper tubes of equal thickness until the composite bars were three quarters of an inch in diameter. The ends were carefully squared up, and the bars drawn 10, 20, 30, 40 and 50 percent reduction through dies with total angles of 5, 10 and 30 degrees. The bars were then split, polished and etched, so that each bar showed, in longitudinal section on center, the thickness of the core and of the layers. One bar in each series was stopped and backed out of the die, so that the polished section showed how the metal flowed in the die.

The squared end of each finished bar was cupped, as in the case of solid bars, the depth of the cup varying with the severity of the draft and with the die angle. The cup was smooth showing no steps at the tube junctions. The core and tubular layers were reduced with absolute uniformity at every draft, so that for instance in a 20% draft, each tube lost the same percentage of the thickness, and the core lost a proportionate amount. Wire drawing evidently works the whole section uniformly. Where the bar first feels the pinch of the die the change in direction of the layer boundaries is not a sharp angle, but an easy curve, as is also the change at the conclusion of the draft. The reduction is evidently effected by direct shearing stresses. The core of the wire feels the pinch before the skin directly over that portion of the core has made contact with the die, and the metal bulges forward, as has been often proven in previous experiment. There appears to be absolutely no holding back of the surface by reason of its frictional contact with the die.

The exact behavior of the concentric layers is well shown in a series of photographs and diagrams accompanying the paper, and well summarized by the authors in the following words—

"The boundary surfaces between layers, which are cylindrical both before and after drawing, assume in the reduction zone the form of surfaces of frusta of a series of cones of common axis and common apex; the apex of these cones is identical with that of the cone defined by the bearing of the die. The more nearly the individual layers approach the centre of the rod the further back from the emergent side of the die is reduction found to commence and to finish. The loci of incipient reduction, of equivalent stages of reduction, and of completed reduction are a series of spherical caps, radially parallel to one another and bounded by the bearing of the die, all of which have a common centre at the apex of the cone the surface of a frustum of which forms the bearing of the die. Reduction thus appears to be effected by pure shear stress.

It is suggested that the behavior of these composite rods is exactly comparable with that of solid round rods under similar conditions".

Notes on the Relation Between Reduction of Area by Cold-Drawing and Tensile Strength of H.-C. Copper

(Experiments In Wire-Drawing. Part II)

By W. E. Alkins, M. Sc.

A Digest of a Paper Presented Before the British Institute of Metals

ANNEALED copper rod 0.435 inch diameter was drawn through straight-sided dies tapering at 5° at single drafts of slowly increasing amount. The resulting "primary" tensile strength /reduction of area curve consists of an approximately rectilinear portion up to about 15 per cent. reduction and of a smooth curve concave to the reduction axis from 15 per cent. upwards. Below 15 per cent. the results are consistent with the view that drawing takes place by simple elongation under tensile stress. Above 15 per cent. the curve has the form of a rectangular hyperbola and one asymptote appears to lie suggestively near the limiting tensile strength to which copper can be cold-drawn.

When reduction is effected by a series of successive drafts, the tensile strengths attained for any

given reduction of the original area are lower the lighter the drafting.

The maximum reduction possible at a single draft from annealed rod under these conditions is about 56 per cent. Successive drafts of 50 per cent. are not possible, but successive drafts with a reduction of 40 per cent, at each pass can be effected.

The Attack on Mild Steel in Hot-Galvanizing.

By Edward J. Daniels, M. Sc.

A Digest Of A Paper Presented Before The British Institute Of Metals

MR. DANIELS finds that, contrary to a belief based on previous experiment that the addition of aluminum to the bath reduces the attack on the kettle, aluminum in small amounts increases the rate of attack. Tin and antimony, on the other hand, increase the rate of attack so very little that their effect may be ignored. A surprising result of this research is the discovery that the presence of cadmium in amounts ranging from 1 to 10 percent greatly increases the attack on the kettle walls. Cadmium itself has no effect, but its presence in zinc causes the protective layer of Fe Zn 7 adhering to the kettle wall to become porous and granular, and to fall away from the walls, permitting a fresh attack. When the percentage of cadmium reaches 60, the attack is checked, and proceeds at the same rate as with pure zinc.

As soon as the kettle is filled, a solid continuous layer, essentially Fe Zn 7 forms on the walls, and, below the critical temperature, protects them against further attack to a considerable degree. Further attack must proceed by the diffusion of zinc through the protective layer, a process which becomes slower and slower as the layer increases in thickness. Above the critical temperature however, the layer of zinc-iron alloy becomes porous and drops off, this effect being hastened by movement.

The critical temperature is 896 Fahr. It is emphasized that the significant temperature is that at the inner edge of the kettle wall, rather than in the center of the bath. Mr. Daniels presents a formula for calculating loss of metal at different temperatures, from which astonishing results are obtained. The life of a kettle with a wall thickness of one and one-half inches, maintained at a constant temperature of 932 will be twenty eight days. At a temperature of 890 the life will be one thousand four hundred and eighty seven years.

The Drawing of Non-Ferrous Wires

By E. L. Francis, M. Sc. and Professor F. C. Thompson, D. Met., M. Sc.

A Digest Of A Paper Presented Before The British Institute Of Metals

IN a series of experiments on a large range of non-ferrous materials in varying die angles, various die materials, and different lubricating conditions Messrs. Francis and Thompson have established a number of interesting relations.

They find that although at extremely slow speed the die pull is uncertain, and tends to be unduly high, in the range in which wire drawing is commonly done, say 20 to 600 f.p.m., there is no variation in die pull. This suggests that laboratory experiments conducted at low speed on testing machines may be unsatisfactory unless extreme care is used in maintaining uniform and satisfactory lubricating conditions.

A considerable difference is noted in the die pull required in steel and in tungsten carbide dies, the latter naturally showing lighter and steadier pulls, and diamond dies are found still more efficient than tungsten carbide. These differences are quite marked when soft or wet lubricants are used, but tend to fade out with a soap coating. It is suggested that the makers of non-ferrous wires may profitably adopt, so far as practicable, the steel-wire practise of a lime-soap coat. Soap solution will not do so well as the dry soap coating.

A study is made of the effect of die angle on die pull at two different percentages of reduction, and the existence of a "best angle" for each set of conditions is clearly indicated, the difference being especially great with large reductions. The best angle appears to vary with the reduction, and not with the nature of the metal, nor the lubricant. It is shown definitely that a flat sided cone is superior to a radial cone. The influence of degree of polish is touched upon, and while the experiments in this direction seem not to have been extensive a good polish is clearly superior to a moderate polish. The better the polish the lower and the more uniform are the die pulls.

The authors have made some calculations for the determination of coefficient of friction, but freely admit that the subject is obscure.

Endurance Tests on Patented and Drawn Wire

The Following is a Summary of a Contribution by Three Authors in a Recent Issue of "Jernkontorets Annaler"

Wires with carbon contents from 0.43 to 0.83 per cent, and reduced by drawing from 44 to 90 per cent, were subjected to endurance tests with varying tension in a machine constructed by A. Lindberg (one of the authors), and the results were compared with tensile, bending and torsion tests. The best endurance was found in wires with low carbon content subjected to intermediate reduction by drawing. A good correlation was found between the bending tests and the fatigue tests, while the tensile and torsion tests gave no indication of the endurance of the wires.

Endurance tests with varying tension were also performed on ropes of 42 wires. When normal heat-treating was employed (temperature of furnace 1,000 deg. C., temperature of lead-bath 550 deg. C.) those ropes showed the best endurance which were made from wire with a low carbon content (0.43 per cent.) and drawn 6 to 8 passes (reduction 80 to 90 per cent.) The experiments indicate, however, that by modifying the heat-treatment it is possible to obtain good results also with higher contents of carbon.

(*Please turn to page 448*)

Automatic Combustion Control Systems for Wire Furnaces

By F. Aschner and H. Mayer-Witten*

Part II—Sec. I

Automatic furnace control is of special significance in the manufacture of wire, since the economy of the process and the quality of the production largely depends upon the management of the furnaces and ovens.

The present articles deal with the regulating systems developed in Germany; Part I, covered the types of regulators used and Part II, showing the complete equipment and working results.

IN the previous article the different appliances for regulating the heat supply and for controlling the combustion air in industrial furnaces for the wire making industry were described. The present treatise deals with examples showing how the regulators are incorporated into complete stove installations and also mentions practical results which could be derived by the use of automatic regulation.

Automatic regulation can be most readily incorporated in the entire installation when electrically heated furnaces are employed, as in this instance, the extension of the connections existing for every normal stove, enable the heating circuit to be switched in or out according to the temperature.

✦ ✦ ✦

FIG. 1 shows the connections of an AEG annealing furnace which is switched in or out according to the prevailing temperature by a contact transmitter combined with the thermostat. When the contact is closed, the mercury switch 6 completes the circuit for the alternating current contactor 5 which, in turn, controls the heating circuit for the furnace. The heat supply is consequently switched in or interrupted intermittently according to the temperature of the stove.

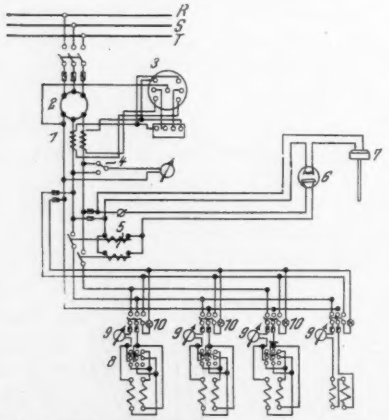

Fig. 1—Diagram of connections of an electrically heated annealing furnace, designed by the Allgemeine Elektricitäts-Gesellschaft (AEG): 1. Current transformer. 2. kWh meter. 3. Wattmeter. 4. Change-over switch. 5. A. C. contactor. 6. Mercury tilting switch. 7. Temperature regulator. 8. Change-over switch. 9. Ammeter. 10. Signal lamp. ✦ ✦ ✦

With fairly large furnaces, i. e., with large heating currents, the use of a star-delta change-over switch reduces the current rushes which would arise if the stove were cut out entirely. A highly sensitive temperature detector which is correctly built into the stove and which actuates on the smallest change in the heating temperature, is essential for serviceable regulation.

✦ ✦ ✦

FIG. 2 illustrates an existing AEG annealing furnace employed also in wire making; this installation is equipped with automatic electrical regulation.

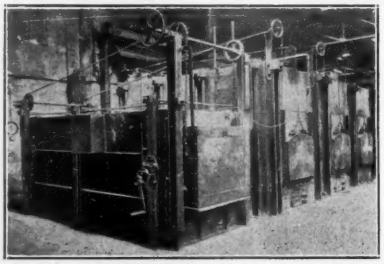

Fig. 2—(a) AEG annealing furnace. ✦ ✦

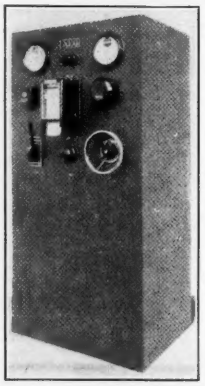

Fig. 2 (b)—Switch cubical with regulating gear for 2 (a). ✦ ✦

The next example of a temperature regulator, manufactured by Messrs. Hartmann & Braun, Frankfurt a/M. gives occasion for treating the star-delta change-over connections, as previously mentioned, in greater detail. The Hartmann & Braun regulator may be classified as a limiting contact transmitter and is reproduced in Figs. 3a and 3b.

✦ ✦ ✦

THE mercury tilting tube switches constitute a special feature of this construction. The regulating impulse actuates a

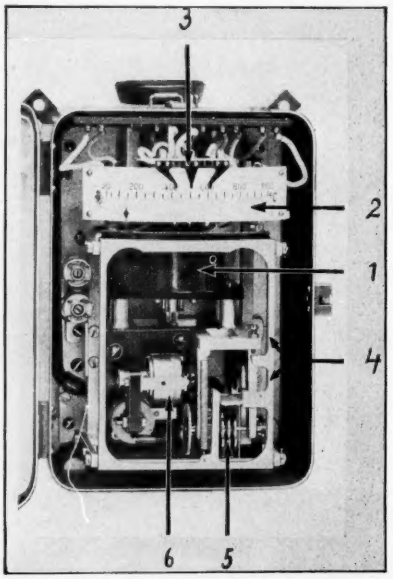

Fig. 3—(a) Hartmann and Braun temperature regulator relay: 1. Measuring mechanism. 2. Scale. 3. Contact block with adjusting device. 4. Moving frame. 5. Cam wheels for moving frame. 6. Motor for moving frame. ✦ ✦

Fig. 3b—Contact block with mercury tilting switch.

cross coil or a moving coil measuring system. The pointer of the measuring system moves over a scale. A motor which runs continuously, raises a moving frame at regular intervals. At each end of the scale are contact blocks which contain the mercury switching tubes the supports of which are subjected to the pressure of a push rod. If the pointer is immediately under a push rod when the moving frame is raised, it lifts the push rod by way of a lug on the pointer, thus tipping the mercury switch and instigating the switching process depicted in Fig. 4.

✦ ✦ ✦

THE switches are denoted I—V, three of which serve for regulation. The switches I and V at the extremities of the scale operate alarm devices which function if disturbances arise in the plant, i.e., if the pointer reaches either extreme position. The diagram of connections enables the general scheme of the system to be followed.

Manual operation of the push button sets the stove and the regulation into service. The auxiliary relay R 1 is energized and opens the circuit b, c, d; at d the star contactor C trips, and consequently the delta contactor C receives current by way of the contact e which is now closed. The delta connections are employed while heating up the stove. The retaining circuit is closed by way of the contact f and the spring-loaded switch tube III. Consequently the reopening of the push button switch D exerts no influence. When the temperature attains the value corresponding to the setting of the switching tube II (minimum regulating contact) the operation of this tube has no effect if the delta connections are used.

Only when the temperature corresponding to the setting of switching tube III (normal contact) is attained, is the retaining circuit interrupted, whereupon the delta contactor trips and closes the contact C so that closing of the star contactor can take place.

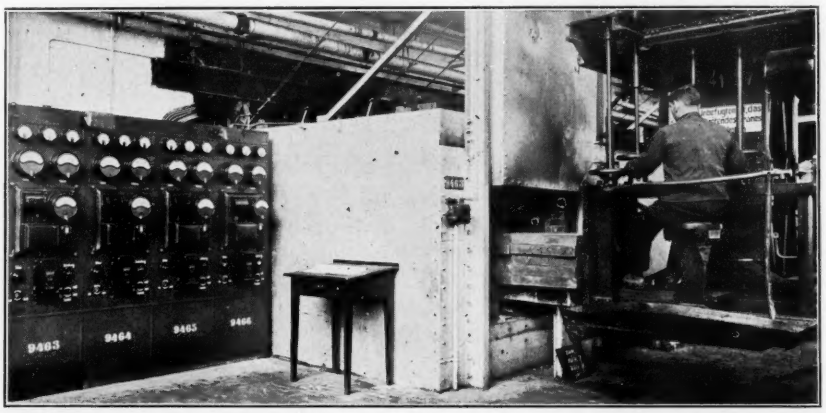

Fig. 5—Ingot furnace with Hirsch-Kupfer regulating and supervising plant. ✦ ✦ ✦

If the influence of the star connections causes the temperature to increase up to the adjusted maximum, and closes switching tube IV, the auxiliary relay R2 is energized. The retaining current is obtained by way of contact g and the star contactor is switched out over b. The heating is consequently entirely cut out.

If the temperature of the stove falls to the minimum value (switching tube II), the delta contactor is again switched in, and the regulating process as described above is repeated.

✦ ✦ ✦

AN automatic electrical regulation installation constructed by the "Hirsch Kupfer und Messing Werke AG" is shown in Fig. 5; the regulating principle, newly developed and employed in conjunction with a modern ingot heating furnace, is similar to that used with annealing furnaces as described above. By means of an

(*Please turn to page 446*)

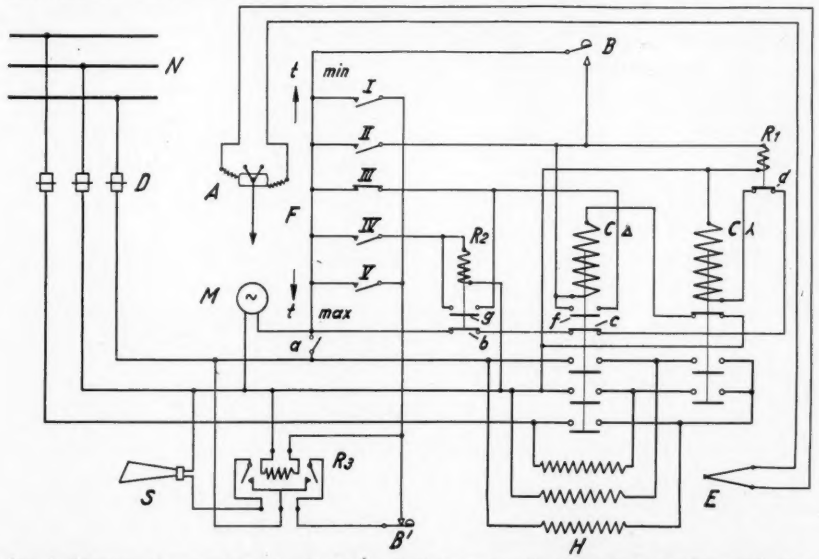

Fig. 4—Diagram of connections of a Hartmann & Braun automatic temperature regulator with star-delta change-over for the heating winding of the furnace. A. Measuring mechanism. B. Push button switch for hand operation. B¹. Push-button interrupting the signal. C. Delta contactor. C. Star contactor. D. Fuses. E. Thermo-couple. F. Contact block. H. Heating resistance. M. Motor for moving frame. N. Three phase network. R_1. Auxiliary relay. R_2. Auxiliary relay. R_3. Signal relay. S. Alarm syrene. I-V Switching tubes. a-g. Switches. ✦ ✦ ✦ ✦ ✦ ✦

Outstanding Personalities of the Wire Industry

E. Howard Johnson, President of the Corone Wire Insulators Co., Inc., Putnam, Conn., has had a long and wide experience in the wire industry.

Mr. Johnson was formerly with Kerite Co., Hazard Manufacturing Co., Standard Underground Cable Co., and, from its organization in 1902 until 1924 Vice President and Works Manager of the Atlantic Insulated Wire & Cable Co., which Company, due to his knowledge of rubber, mechanical ability and management, achieved success and distinction in the manufacture of high grade rubber covered wires and cables of nearly all types including submarine cables in continuous lengths up to 100 miles, many hundreds of miles of which were furnished the U. S. Government.

After retiring from the Atlantic Co., organized the Corone Wire Insulators, Inc., and has conducted a successful business in special high tension resisting mixtures for wire insulations, together with the marketing of his patented Super Production Tubing and Straining machines.

Charles M. Gearing, division manager of the Meriden plant, and a member of the board of directors of the New Departure manufacturing Company, has been selected to fill the position of general works manager with offices in Bristol, according to an announcement by the management. Mr. Gearing, who has been in charge of the Meriden plant for the last eleven years, will have charge of the general supervision of production of the New Departure plants, in Hartford, Bristol and Meriden. He has been associated with the company since 1890. He is a director of the Meriden National Bank and a member of the board of trustees of the Meriden Savings Bank.

✦ ✦ ✦

F. C. Ryan has been appointed sales manager of Newark Wire Cloth Co., Newark, N. J. He was graduated in chemical engineering from Lehigh university. He formerly was sales engineer for the New Jersey Zinc Co., and more recently was staff manager with Johns-Manville Sales Corp.

✦ ✦ ✦

E. H. Lang has been appointed factory superintendent of the Sharon, Pa., works of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He succeeds M. L. Fawcett, whose promotion to manager at Sharon was noted in Steel last week. Mr. Lang formerly was assistant factory superintendent.

✦ ✦ ✦

R. C. Todd, assistant general manager of sales of the American Rolling Mill Co., Middletown, Ohio, has been appointed assistant vice-president. He has been succeeded by **H. M. Richards,** who has been manager of the Cleveland sales district. Mr. Todd joined the Armco organization in 1900, and in 1924 was made assistant general manager of sales. Mr. Richards entered the Armco organization as a clerk in the order department in 1913, became manager of the Cleveland district in 1924.

✦ ✦ ✦

W. P. Witherow has resigned as vice president of the Republic Steel Corporation to devote his time to his many private and personal interests which have multiplied greatly in past years.

He was president of Witherow Steel Corporation, chairman of Donner Steel Company, and became vice president of Republic Steel Corporation after Donner was merged with Republic.

✦ ✦ ✦

Harry J. Fisher, formerly sales manager of the Reliance Electric Engineering Co., Cleveland, has been appointed manager of sales for the Aetna Standard Engineering Co., Youngstown, and will assume his new duties on Nov. 2.

He was graduated from the University of Michigan in 1913 and has been instrumental in the development of numerous steel plant improvements, including the application of electric motors to wire blocks and the development of individually driven table rollers.

✦ ✦ ✦

Harry L. Erlicher, who entered the employ of the General Electric Co. as an office boy in the purchasing department, has been appointed purchasing agent, succeeding L. G. Banker, who retired on Oct. 1 after completing 43 years of continuous service with the company.

✦ ✦ ✦

Albert Jefferson Sayers, noted Link-Belt engineer, 61 years old, passed away at his home 7121 Eggleston Ave., Chicago, on October 11th.

Born September 10, 1870, at Troy, Ohio, and educated at the University of Illinois, he was graduated in the class of 1895. He joined the Link-Belt organization in 1899.

Mr. Sayers is survived by his widow, Mrs. Mabel J. Sayers, his son Robert P.; and a daughter, Edith E. Sayers.

A Review of Recent Wire Patents

No. 1,819,720, SUBMARINE CABLE, Patented August 18, 1931, by Willoughby Statham Smith, of Benchams, Newton Popplefold, Henry Joseph Garnett, of Sevenoak, and Henry Charles Channon, of Kensington, London, England. For telephonic communication, the inventors have patented a cable, comprising a wire core, surrounded by a layer of loading material applied thereto, the latter being surrounded with a pressure equalizing medium comprising a congealed or viscous paraffin hydrocarbon, and a thickener selected from the following: rubber, gutta-percha and balata.

✦ ✦ ✦

No. 1,821,249, WIRE BENDING DIE, Patented Sept. 1, 1931, by Sten Wadsten, of Bloomfield, New Jersey, Assignor to Westinghouse Lamp Company, a Corporation of Pennsylvania.

For the purpose of providing a die for coiling wire in helical coils for lamp filaments, the inventor provides the die with a notch to one side of the intended groove for the wire, the notch permitting the cutting or lapping wheel to cut more deeply into the die head.

✦ ✦ ✦

No. 1,821,250, WIRE COILING DIE, Patented Sept. 1, 1931, by Sten Wadsten, of Bloomfield, New Jersey, Assignor to Westinghouse Lamp Company, a Corporation of Pennsylvania.

An object of the invention is to provide a helically coiled wire die having a numbe rof wire coil winding apertures adapted for substitution one for the other.

✦ ✦ ✦

Nos. 1,821,412 and 1,821,453 to 1,821,-456 inclusive, WOVEN WIRE BELTS FOR PAPER MAKING MACHINES, Patented Sept. 1, 1931, by Nelson W. Webb, of Belleville, New Jersey, Assignor to Eastwood Wire Corporation, of Belleville, New Jersey, a Corporation of New Jersey.

These patents relate to woven wire belts for Fourdrinier type machines, and more particularly to seam structures or jointures between the ends of the length of wire mesh. The inventor provides new lacing wires, arranged in new ways.

✦ ✦ ✦

No. 1,821,731, FENCE STRUCTURE, Patented Sept. 1, 1931, by William H. Sommer, of Peoria, Illinois.

An object of the invention is to so connect the stay wires with the strand wires at their points of intersection as will provide lateral support for the stay wires at the intersection point. The inventor employs Z-shaped wire staples at these points.

✦ ✦ ✦

No. 1,821,845, WIRE DRAWING MACHINE AND PROCESS OF THREADING THE SAME, Patented Sept. 1, 1931, by Edwin J. McIlvried, of Cleveland, Ohio, Assignor to The Vaughn Machinery Company, of Cuyahoga Falls, Ohio.

The machine referred to is of the double deck type, and the process of threading wire comprises passing the leading end of the wire through the first die, coiling it around the finishing surface of the block, stopping the coiling operation, loosening the coil, shifting the coil bodily to the primary surface of the block, unwinding a sufficient length of wire from the coil to react from the primary surface through the finishing die to the finishing surface and passing the leading end through the finishing die and on to the finishing surface of the block.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 551 Fifth Avenue, New York.

✦ ✦ ✦

No. 1,821,887, WIRE CABLE, Patented Sept. 1, 1931, by Frank F. Fowle, of Kenilworth, Illinois, Assignor to Indiana Steel & Wire Company, of Muncie, Indiana, a Corporation of Indiana.

An object of the invention is in the construction of a hollow stranded wire cable, so that there will be a minimum of metal at the center of the cable, and so that for the same quantity of metal, the cable will have a larger diameter.

✦ ✦ ✦

No. 1,821,908, COMPOSITE WIRE CABLE, Patented Sept. 1, 1931, by Frank F. Fowle, of Kenilworth, Illinois, Assignor to Indiana Steel & Wire Company, of Muncie, Indiana, a Corporation of Indiana.

The cable comprises a high strength iron core, a layer of copper wires surrounding the core, and a separator interposed between the core and the layer of copper wires and mechanically distinct therefrom, the separator consisting of two layers of which the inner one has its inner surface of zinc and the outer one has its outer surface of copper.

✦ ✦ ✦

No. 1,822,189, METHOD FOR REDUCING THE EXTENSION OF WIRE ROPES, Patented Sept. 8, 1931, by George Zapf, of Riehlerwall-Cologne, Germany, Assignor to Felten & Guilleaume Carlswerke Actien-Gesellschaft, of Cologne-Mulheim, Germany.

Particularly, this method refers to rope formed of stranded wires, and the method consists of subjecting the wire rope to tensile stresses by applying forces thereto and while they are thus subjected, tightly wrapping the ropes with a helical wire bandage.

✦ ✦ ✦

No. 1,822,738, POLYPHASE INTERSHEATH CABLE, Patented Sept. 8, 1931, by Vladimir Karapetoff, of Ithaca, New York, Assignor to General Electric Compay, a Corporation of New York.

The invention relates particularly to high voltage three phase intersheath cables, the inventor employs a number of intersheaths associated with each conductor, each of the surfaces following a different vector potential with time, each of the vector potentials, however, having equal instantaneous maximum values.

No. 1,822,921, NAIL SORTING MACHINE, Patented Sept. 15, 1931, by Basil Pomeroy Cooper, of Leicester, England, Assignor to United Shoe Machinery Corporation, of Paterson, New Jersey, a Corporation of New Jersey.

This is a one-drum machine for eliminating those nails, upon manufacture, which have heads of a diameter outside of the limits of tolerance permissible for the nails in question. Perforations within the drum pick up such nails as enter the perforations but have heads of a greater diameter than the width of the perforations. The nails having heads of a less diameter than the perforations of course pass through the perforations.

✦ ✦ ✦

No. 1,823,103, CABLE CUTTING MECHANISM, Patented Sept. 15, 1931, by James Forrest Howe, of Worcester, Massachusetts, Assignor to The American Steel and Wire Company, of New Jersey, a Corporation of New Jersey.

For the purpose of providing a mechanism for cutting heavy duty wire rope and cables, the inventor has adapted this device for cutting the same under water, as for use in cutting the wire anchor cables of concrete mattress revestments laid on river banks and the like.

✦ ✦ ✦

No. 1,823,886, WIRE ROPE MACHINE AND THE LIKE, Patented Sept. 22, 1931, by David W. Clark, of Montreal, Canada, Assignor to John A. Roebling's Sons Company, of Trenton, New Jersey, a Corporation of New Jersey.

Objects of the invention are to provide a machine which will preform the wire strands into helics before they are laid in the rope, so that the free ends of the rope will not unravel, but tend to hold closely to the rope core, the preforming means being easily accessible and open for inspection at all times during the operation of the machine.

✦ ✦ ✦

No. 1,823,989, WIRE POLISHING MACHINE. Patented Sept. 22, 1931, by Arthur K. Sanderson, of Aurora, Illinois, Assignor to Love Brothers Incorporated, of Aurora, Illinois, a Corporation of Illinois.

Particularly, this machine is adapted for polishing weatherproofed wire. The polishing dies in this machine are adjustable while the machine is in operation and the auxiliary guide tubes or spindles may be removed and replaced when filled with wax without danger and difficulty.

✦ ✦ ✦

No. 1,825,214, WIRE TRANSFER APPARATUS, Patented Sept. 29, 1931, by George G. Swank, of Crawfordsville, Indiana.

This device is adapted for transferring formed wire coils from the forming block to the reel from which the wire is taken directly, particularly in the manufacture of wire fence fabrics. Coils may be made larger than ordinarily and may weigh as much as 1,000 pounds.

'Round the World With the Wire Industry

Sheffield University Reports On Wire Research

THE report of the Department of Cold Working of Steel and other Ferrous Metals, Sheffield University, has just been issued for the year 1930-31, and, in a resume of the work done during this period, which has been prepared for Wire & Wire Products, it is stated that during the past session the work of the Department has been carried on by the Ironmongers' Company Research Fellow and the Ironmongers' Company Research scholars. The reappointment of F. S. Merrils as Research Fellow for another year has been recommended, and also that of the Research Scholars. During the next session three university scholarship holders will be similarly available.

During the session three programs of research have dealt with the drawing of wire suitable for ropes and springs, the bright drawing of mild steel bars, and the rolling of strip for pressing. The study of wire-drawing has mainly taken the form of experiments to determine the best condition of drawing to obtain a high degree of resistance to fatigue. A special machine has been constructed, and this work will be continued.

An investigation of drawn wires for ropes disclosed unexpected variations in the hardness within the thickness of the wire, and it is hoped that further research will reveal the causes of some of the hitherto unexplained failures of wire ropes in service.

Search is being made for the best form of dies for different sections and qualities of steel. This is being done in conjunction with several important manufacturers, who have supplied their standard dies for the purpose. These reveal such a wide difference in design that the Department is making experiments to ascertain the most suitable type.

Special interest attaches to these researches at Sheffield University, as it is the best-equipped university for metallurgical studies in the United Kingdom.

✦ ✦ ✦

German Pin Exports

GERMANY'S exports of safety and other pins to America, which in 1930 were sharply curtailed, because of the American antidumping import duty, show a sharp rise as a result of the removal of this duty in March of this year. In the first quarter of this year exports to America were 19.4 tons monthly, in April 23.2 tons, in April 30.7 tons, in May 33.2 tons, in June 53.7 tons, in July 36.7 tons and in August 48.5 tons. Still these figures are approximately 40% lower than the average export quantities of 1929.

✦ ✦ ✦

German Wire Rod Export Prices Reduced

THE price for wire rods shipped to America has been reduced to £ 28.15 per ton c. i. f. and a further reduction is anticipated, should the cartel decide to reduce prices for European consumption.

✦ ✦ ✦

German Square Wire Netting Cartel

THE German makers of square wire netting have agreed to establish a cartel, which will include all works, not only the ones which produce the netting from their own raw material but all others. This cartel would become a subsidiary of the wire cartel, as is also the case with the makers of hexagonal wire netting at the moment of writing the agreement has not yet been signed. The average price paid for export for galvanized square wire netting per ton is now some £ 20-21.0 f.o.b.

✦ ✦ ✦

South America Importing More Wire Nails

THE circumstance that, Brazil, Chile and Argentine are buying more wire nails than last year, in spite of import duties and their own production is due to the fact, that the industries in these countries were using too much soft wire for nail production, because the soft wires could be cut easier and at less tool costs. But the consumers are apparently not satisfied with such a proceeding and are paying much more for imported German or Belgian nails.

✦ ✦ ✦

British Markets More Active

BRITISH markets are more active and trade prospects are much improved, although there is some confusion among producers, certain works endeavoring to execute contracts, while others are seeking payment on a gold basis for orders already placed.

With Continental iron and steel shut out of the United Kingdom by depreciation of the pound sterling, British pig iron producers are beginning to increase their sales both for domestic and export consumption.

✦ ✦ ✦

East African Aluminum Wire Trade Decreasing

THE export trade in aluminum wires with East Africa is dying. The natives in East Africa absorbed before the war very great quantities of such wires for ornamental purposes. But the fashion is changing in East Africa; the natives are going back to copper and brass wire and total imports are now only a few tons (first half 1931). On the other side aluminum wire is now being imported for electric transmission lines, especially the Aldrey alloy wires, and Russia, as well as the Far East is buying such wires for this purpose.

✦ ✦ ✦

Earnings of Australia's Largest Steel Works

THE annual report of the Broken Hill Proprietary Company, Ltd., operators of Australia's largest steel works, for the year ended May 31st, 1931, shows that pro-

(*Please turn to page 454*)

Exports and Imports of Wire

Exports of iron and steel wire products in July and August, 1931
(In gross tons)

	August 1931	July 1931	August 1930
Wire rods	2,167	1,708	3,179
Hoops, bands and strip steel	1,811	1,610	20,927
Plain black or galvanized iron or steel wire	1,417	1,049	1,708
Barbed wire and woven wire fencing	2,342	2,169	2,127
Woven wire screen cloth	74	117	214
Wire rope	144	178	306
Insulated iron or steel wire and cable	24	33	21
Other wire and manufactures	320	320	511
Wire nails	622	943	816
Tacks	40	70	30
Other nails including staples	221	298	429
Bolts, machine screws, nuts, rivets and washers	401	437	758
Total, these 12 classifications	9,583	8,932	31,026

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement and other bars	7,443	7,534	4,577
Wire rods	333	687	317
Barbed wire	962	1,492	461
Round iron and steel wire	150	244	297
Telephone and telegraph wire	1	5	19
Flat wire and strip steel	50	91	60
Wire rope and strand	121	69	145
Other wire	31	48	34
Hoops and bands	1,946	1,867	1,734
Nails, tacks and staples	1,305	1,091	636
Bolts, nuts and rivets	37	138	12
Total, these 11 classifications	12,379	13,266	8,292

DECLINES were recorded in both the export and import trade of the United States in iron and steel products during the month of August. Exports, totaling 73,338 gross tons, were 11,128 tons less than those during July, while imports were 7,051 less and totaled only 30,139 tons. Exports averaged 2,366 tons daily and imports 972 tons, against 2,725 tons and 1,199 tons, respectively, in July.

WOOD screw exports were reduced, the August shipments of iron and steel wood screws totaling 327,501 gross valued at $36,099, with those of brass wood screws amounting to 144,819 gross valued at $14,667.

RECEIPTS of card clothing declined slightly in August to total 14,405 square feet, valued at $20,437. The United Kingdom supplied 12,504 square feet ($17,488) with the rest coming from Germany.

IMPORTS of wire cloth and screening rose to 32,035 square feet—14,940 square feet coming from Germany, 12,339 square feet from France, 3,931 square feet from Canada, and the rest from the United Kingdom.

THE trade in Fourdrinier and other paper-making wires continued its climb to total 89,009 square feet—65,373 square feet coming from Germany, 15,218 square feet from France, 5,502 square feet from Austria, and 2,916 square feet from Sweden.

IMPORTS of wire fencing and netting continued to increase—that galvanized before weaving to 2,070,985 square feet (all from Germany) and that galvanized after weaving to 5,230,568 square feet—2,733,568 square feet of which came from Germany, 1,878,750 square feet from the Netherlands, and 618,250 square feet from Belgium.

WIRE heddle imports rose sharply to 4,304,000 pieces—2,200,000 coming from France, 1,020,000 from the United Kingdom, 732,000 from Germany, and 352,000 from Switzerland.

THE trade in wood screws totaled 21,880 gross, valued at $2,073—the entire quantity received coming from Sweden.

HEAT treating is an important factor in the manufacture of the Wedge Nut Lock, a product of the Labbe Manufacturing Company Incorporated, of Denver. The nut lock is made in 12 standard sizes, from American spring steel annealed wire, drawn especially for the purpose.

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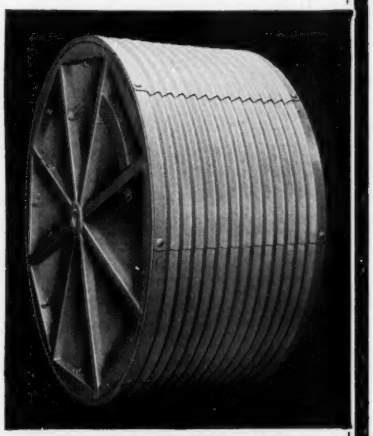

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(*Continued from page 441*)

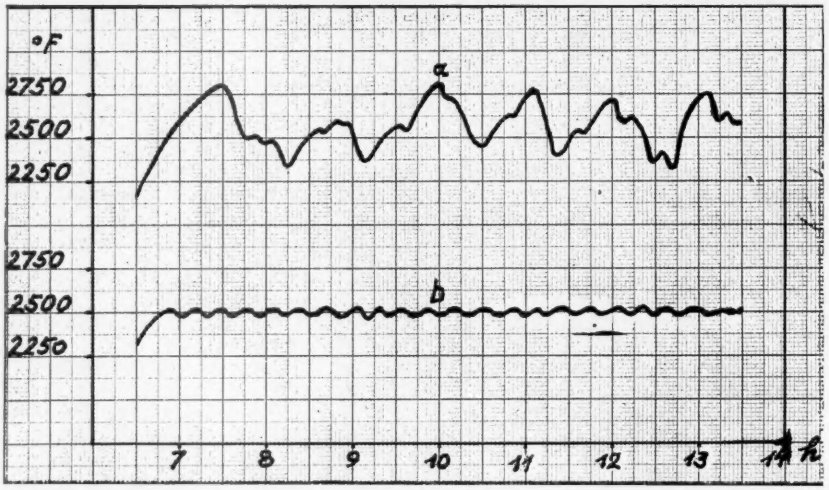


Fig. 6. Temperature characteristic for an annealing furnace; reproduced from original chart. a. Without regulator. b. With regulator.

accessible switch, regulation can be changed over to manual operation.

The regulators are manufactured by Messrs. Hirsch Kupferwerke, and when compared with the regulator system described above, they are characterised by the fact that the alternating current which is used for heating the furnace and which generally controls the switching relay is rectified before being applied to the relay whereby the noise and vibration otherwise often accompanying the use of alternating current relays are entirely avoided.

TESTS which were carried out on an industrial furnace with and without Hirsch Kupfer automatic regulator, resulted in the diagram reproduced in Fig. 6. With manual operation, the actual temperature deviated by up to 8% from the nominal value, but, on the termination of the heating-up period, the regulator maintained the temperature practically constant during the entire smelting process. The temperature difference between the maximum and minimum regulator contacts as set on the regulator and appreciable in the diagram, could be limited to ± 20° C, i. e., only about ± 1.5% of the nominal value.

+ + +

The Final Article in This Series Will Appear in The January Number

+ + + + + + + + +

FOR revolving screen jackets, vibrating screen sections and other rough, abrasive applications, the **Ludlow-Saylor Wire Co.**, St. Louis, is now offering its alloy steel coarse-mesh woven wire screens.

These screens, bearing the trade name of "Spring-Steel," are available in approximately 250 grades and meshes, with openings ranging from 4 in. down to 1/16 in. The former are made from heavy "Spring-Steel" bars and the latter from No. 20 wire of the same material.

PAGE Steel & Wire Company of Monessen, Pennsylvania, has received an order from the American Cable Company of New York and affiliates for special steel wire to be used in the Golden Gate bridge, San Francisco, involving approximately $6,250,000.

The order will require over a year to fill, and shipments are expected to start about January 10th. The Page company will manufacture all wire to be used in the main cable and suspended rope which will be fabricated in the plant of the American Cable Company.

Rust Protection of Wire Products With Cadmium

(*Continued from page 434*)

one. The reason for this being that as cadmium is now deposited from most processes it is deposited in a relatively non-porous and dense form and assuming that all deposits are made in a form possessing desirable physical characteristics, the protection provided is dependent on the thickness of the plate and with this fact in mind it would appear that a rapid, reasonably accurate method of estimating the thickness of deposit would be of most value commercially.

Chemical analysis and physical measurements will determine this accurately but their use is limited to laboratories and furthermore they require considerable time.

The hydrogen evolution method using inhibited hydrochloric acid, when conditions of temperature are closely observed, provide a rapid and fairly accurate means of estimating the thickness of deposit for most iron and steel products but is useless for certain types of castings.

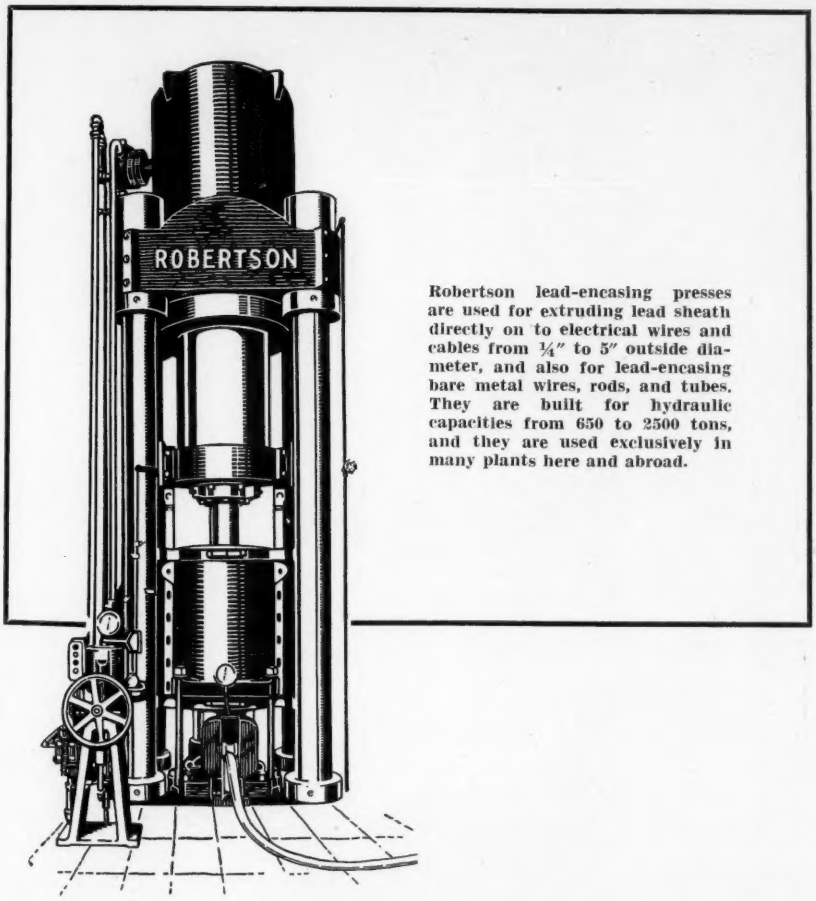
✦ ✦ ✦

Appearance

A thin deposit of cadmium has the same appearance as a heavy deposit and unless specifications are made and met, based on the thickness of deposit, the results are often disappointing and costly. It is essential that a rapid and accurate means of testing the thickness of deposit be employed in order that those interested in rustproofing their products with cadmium can specify, and test, buy and sell a certain degree of rust protection.

✦ ✦ ✦

Note 1. W. G. Imhoff. Iron Age. October 4, 1920.
Note 2. H. S. Rawdon. Trans. American Electrochemical Society. Vol. 49, p. 339, 1926.
Note 3. Russel & Woolrich. British Patent 12,526. (1849).
Note 4. U. S. Patents 1,383,174 and 1,383,175. June 28, 1921. 1,564,413 Jan. 17, 1924. 1,564,414 Oct. 6, 1924. 1,681,509 Aug. 21, 1928.
Note 5. C. M. Hoff, Trans. American Electrochemical Society. Vol. 50 p. 301. 1926.
Note 6. L. R. Westbrook. Trans. American Electrochemical Society. Vol. 55 p. 101. 1929.
Note 7. U. S. Patent 1,383,174. June 28, 1921.
Note 8. U. S. Army Spec. No. 3-100-A. Feb. 15, 1927.
Note 9. U. S. Patent 1,742,986. Jan. 7, 1930. and patents pending.
Note 10. U. S. Patent 1,742,986. Jan. 7, 1930. and patents pending.



Robertson lead-encasing presses are used for extruding lead sheath directly on to electrical wires and cables from ¼" to 5" outside diameter, and also for lead-encasing bare metal wires, rods, and tubes. They are built for hydraulic capacities from 650 to 2500 tons, and they are used exclusively in many plants here and abroad.

"The Stamp of User Approval!"

Note

Complete Robertson Equipment includes lead pipe and trap extrusion presses—solder and lead wire presses—non ferrous extrusion presses—lead encasing presses for electric cables and rubber hose—together with allied supplementary equipment such as hydraulic pumps, furnaces and pots, dies and cores, accumulators, strippers, etc.

The stamp of user approval is clearly indicated through wide usage.

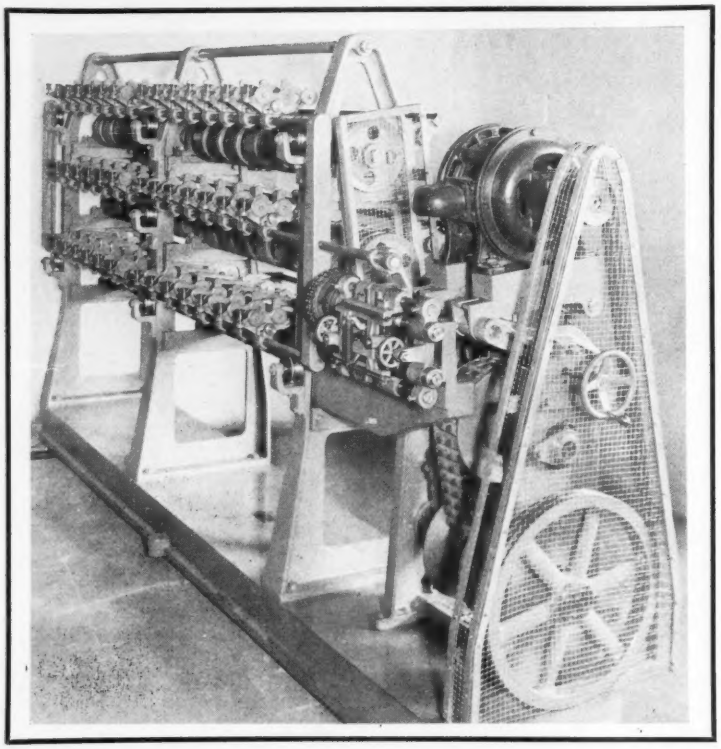
Robertson lead encasing presses are extensively used by leading makers of wire and electrical cable here and in many foreign countries, where Robertson Equipment is virtually a standard thing.

The stamp of user approval is never given very quickly, for it has to be earned, and it cannot be obtained on short acquaintance.

Robertson has had nearly seventy-five years experience in the field of lead presses and allied equipment . . . . Thus is the name ROBERTSON, with all it implies, *the stamp of user approval in itself.* WRITE FOR BULLETINS.

John ROBERTSON CO. INC. Pioneers-Since 1858
123-131 Water Street Brooklyn, N.Y.

Rod, Wire, Cable, Strip and Tube Machinery



42 Wire Spooler
For Use With Multi-Strand Bright Annealing Furnace

WE BUILD

Chain Draw Benches—Multiple Coil Winders.
Flat Wire Rolling Mills—Rod Pointers.
Hollow Wire Straighteners and Equipment.
Multiple Strand Bright Annealing Units.
Stranders to Customers' Specifications.
Reelers and Spoolers for all sizes of Wire and Cable.
Reelers and Spoolers for Tinning, Galvanizing, Patenting and Annealing.

Frederick M. Conran

Designer and Builder of Special Machinery

107 Colden St., Newark, N. J.

Endurance Tests On Patented and Drawn Wire

(*Continued from page 439*)

No pronounced connection was found between the different wire tests and the endurance tests on ropes. In certain circumstances, however, the torsion test gives an indication if a wire is suitable for rope. The endurance machine for wire seems especially promising for the testing of spring wire.

✦ ✦ ✦

Solubility of Armco Iron Into Melted Zinc

HERIBERT Grubitsch in Stahl and Eisen of 3 Sept., 1931 describes a research into the solubility of Armco Iron in melted zinc. The work was done strictly under laboratory conditions, the reaction being between Armco Iron and chemically pure zinc in an atmosphere of pure dry nitrogen. Results were calculated on the basis of percentage loss of weight by the iron samples.

The usual critical temperature is found at about 986 F. at or below which the attack is extremely slow, and becomes progressively slower due apparently to the protective nature of the alloy coating and the extreme slowness of diffusion through it. Above this temperature the rate of attack rises very rapidly, the shape of the charted curves showing clearly that the coating either falls away or fails to protect the iron so that at a temperature of about 923 F., the loss of iron is almost directly proportional to the time of exposure.

A fact not generally known, and possibly of academic interest only, is that at a higher temperature in the neighborhood of 968 F. the attack is considerably slower, and the loss of iron ceases to be in direct proportion to the time of exposure, indicating possibly that the alloy regains its property of sticking to the iron and affording partial protection. This becomes strongly marked at about 1022 F. at which temperature although the attack is too rapid to be tolerated in mill operation, its rate again becomes independent of time. One might deduce from the curves that the zinc-iron alloy is again clinging to the iron, and is relatively non-

porous, but the diffusion is decidedly faster than below the first critical temperature.

Mr. Grubitsch summarizes briefly the results of previous researches, notes that the presence of carbon phosphorus and silicon lower the resistance of the iron to attack and that the presence of manganese raises the resistance. The marked effect of 1% of cadmium in increasing corrosive action of zinc on iron is noted. Other investigators are quoted regarding the effect of nickle and chromium in the iron, and the astonishing statement is made on the authority of Mr. A. Sang that 6% of nickel renders iron insoluble in zinc.

✦ ✦ ✦

Statement of ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of Wire & Wire Products published monthly at Washington, N. J., for Oct. 1, 1931.

State of New York, County of New York, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. S. Spengel, who, having been duly sworn according to law, deposes and says that she is the Secretary-Teasurer of Wire & Wire Products and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Quinn-Brown Publishing Corporation, 551 Fifth Avenue, N. Y. City; editor, Morris A. Hall, 551 Fifth Avenue, N. Y. City; managing editor, none; business manager, Richard E. Brown, 551 Fifth Avenue, N. Y. City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Quinn-Brown Publishing Corporation, 551 Fifth Avenue, New York City, Geo. I. Baker, Hammonton, N. J., and Leta B. Brown, of 551 Fifth Avenue, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

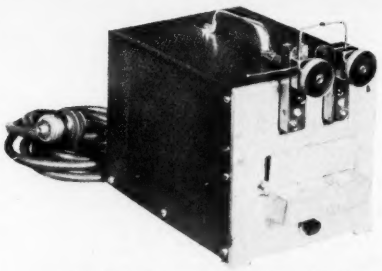
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has interest direct or indirect in the said stock, bonds, or other securities than as so stated by her.

R. S. SPENGEL,
(Secretary-Treasurer)

Sworn to and subscribed before me this 19th day of October, 1931

(SEAL) L. D. SCHWAERER,
Notary Public.

My commission expires March 30, 1932.



Electrical Wire Brazing and Stripping Machines

Model M-131 Portable Brazer

Photograph at right shows girl operator stripping—a slight pressure on foot pedal and a twist of the wrist and the wire is cleanly stripped.

SEND FOR CIRCULAR W-30

Manufactured under Western Electric Patents by

Midwestern Tool Co.

Manufacturers of Special Machinery and Tools, Cutters, Dies, etc.
2811 North Ashland Avenue
CHICAGO, ILL.—U. S. A.

Metal Spools for Wire Drawing

Metal Spools for Annealing

Metal Bound Spools for Shipping

Metal Bound Reels for Shipping

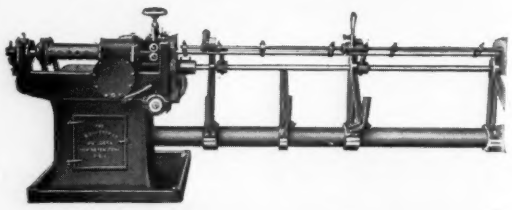
Hubbard Spool Co.

1620-32 Carroll Avenue
Chicago

EXACT LENGTHS OF WIRE

CUT ON

SHUSTER STRAIGHTENING AND CUTTING MACHINES



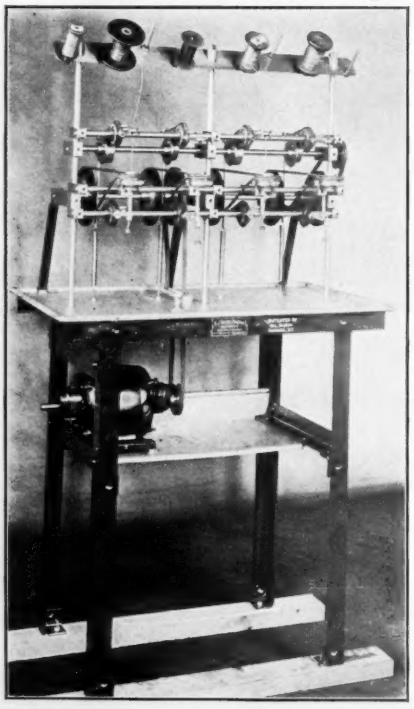
Geared for high speed. Steel fliers, Timken Bearings, and other special patented features.

May we send Catalogue No. 30?

The F. B. Shuster Company New Haven, Conn.

Straightener Specialists Since 1866

The Haddow Die Re-Cutting and Polishing Machine will lower your die re-cutting cost to a fraction of present costs



Why do you continue to pay a die cutter and pay for diamond dust to remove a large percentage of your diamond from your dies? Diamond that has done no work—when, by the use of the Haddow Die Recutting Machine you may use practically all your diamonds to draw wire, especially in the small sizes.

ONE MONTH'S SHOP PRODUCTION

Total number of dies cut —1047

Total number of hours required—182.5

Average number of dies per hour—5.73

Number of operators—1

With only one man—This machine will do the work now requiring four to six men in less time and at lower cost.

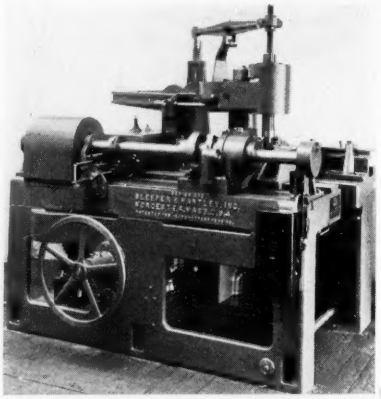
4 HEAD MACHINE—Also Made in 6-Head size (With 2 Heads for Heavier Dies).

WILLIAM HADDOW

17 Eastern Ave.
Ossining, N. Y.

New Type of Torsion Spring Winding Machine

SHIPPED to the Soviet Government where it will go into production work immediately at the Autostroy Doskino plant, the new No. 2½ Torsion Spring Winding Machine just completed by Sleeper & Hartley, Inc., of Worcester, Mass., designers and builders of spring coiling and wire drawing machinery, is of novel construction.



Sleeper & Hartley, Inc., No. 2½ Torsion Spring Winding Machine.

For some time the springmakers of the United States and foreign countries have felt the lack of a torsion spring machine which would produce automatically springs of heavy wire with a large number of coils in the spring body at comparatively high speeds. Sleeper & Hartley, after a study covering several years, has devised this model to meet these demands and the first machine, completed in September, met the exacting requirements of the Soviet so completely that it was purchased immediately.

This machine coils wire ranging from No. 14 (.0800) to ¼". In the smaller wire sizes it will produce springs with up to fifty coils at 20 springs a minute, while in the larger wire sizes, twenty-five coils may be wound into a spring at 10 springs per minute. Regardless of wire size, projecting ends up to 7" and 12" long may be left on either or both ends of the spriig body, and in some cases these ends may be formed automatically as they come from the machine. Coils up to 4" O.D. may be produced.

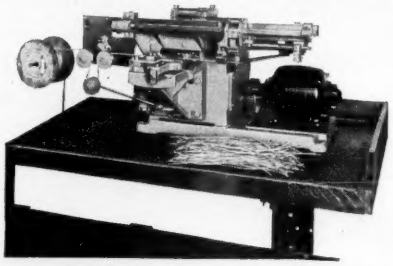
A wide field of utility is embraced by this machine which should find particular use in the automotive, agricultural implement, tractor and other plants. Occupying but 6″ by 4′6″ the machine effects a great saving in floor space over previous types.

The machine has been carefully designed to give exceptionally long life and accuracy of product, regardless of the number of coils of wire used in the spring. Nine major adjusting points assure a careful and accurate control of any feature of the spring dimensions. The machine is particularly powerful, the frames being exceptionally heavy and strong, while ease of operation is due to the extensive use of anti-friction bearings, each and every rotating part turning on, or in, ball or roller bearings. This machine is motor driven, the motor being mounted between the frames and out of the way of dust and dirt.

✦ ✦ ✦

Combination Measuring, Cutting and Stripping Machine

A high production combination Measuring, Cutting and Stripping Machine for long length cords and wires has been developed by the Artos Engineering Company, 327



East Brown Street, Milwaukee, Wisconsin. The machine is adjustable for any length from 12″ minimum to 20′ maximum. Stripping length is adjustable from ¼″ up to 2″ on either end. Production capacity is 1800 pieces per hour for lengths from 12″ to 10′ and 900 pieces per hour for lengths from 10′ to 20′. Machine will handle single conductor wires, two conductor heater cords, parallel conductor lamp cords and multiple conductor service cords. On Heater cords and Lamp cords an attachment can be used where-

HUDSON WIRE CO.
Successors Royle & Akin
Fine Wire Manufacturers
OSSINING Established 1902 NEW YORK

Manufacturers of Fine Bare Wires

Copper Wire Specially Processed for Enameling Purposes

Copper	Lead
High Brass	Zinc
Low Brass	Commercial Bronze
Pure Tin	Phosphor Bronze
Cadmium	Silver Plated Copper
Bronze, Various Grades	False Gold

10%, 18%, 30% Nickel Silver

LAHN

False Gold Copper Silver Plated Copper

BRUSH WIRES CRIMP and STRAIGHT

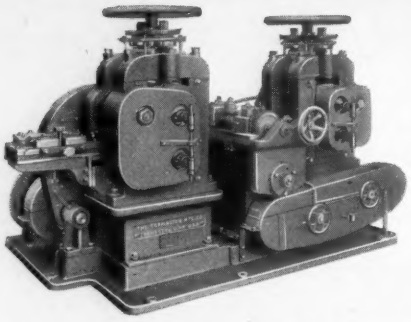
Brass	Copper
Steel	Nickel Silver
	Phosphor Bronze

Metallic Fibre for Packing Purposes

BRAND
"B"
Wire Drawing Soap Powder
Made from high titre Palm Oil stock for high carbon drawing.
Proven by test to lower costs and improve efficiency.
Manufactured exclusively for wire drawing by

THE J. T. ROBERTSON CO., INC.
SYRACUSE, N. Y.
Wire drawing soap specialists since 1893.

STEELSKIN
REG. U. S. PAT. OFFICE
For High or Low Carbon Wire
WIRE DRAWING SOAPS
Established 25 years.
R. H. MILLER CO., Inc. Homer, N. Y.



B-1193
FLAT WIRE MILL

A three stand tandem rolling mill for producing flat wire with round edges or round corners from round rod. The mill successively flattens round edges and finish rolls round wire with subsequent traverse winding on a receive reel stand or take-up.

Drive by 50 HP adjustable speed motor with slip friction adjustable while running to accommodate intermediate speeds to wire elongation.

A complete set of guides incorporated in the design including a quickly operated guide to straighten the entering coil.

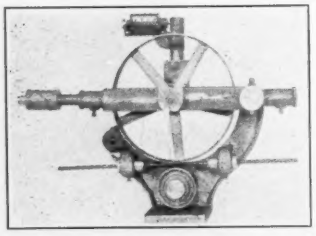
Linear speed 150-450 feet per minute.

The Torrington Mfg. Co.
Torrington - Conn, U.S.A.
44 Franklin St.

RUESCH

SPECIAL MACHINERY
DESIGNED AND BUILT FOR
WIRE, TUBE AND BRASS MILLS

H. J. RUESCH MACHINE CO.
409 MULBERRY ST. NEWARK, N. J.



IMPROVED
Wire Measuring Machine

For measuring bare and insulated wire.
The new patented double grip model gives you more correct measurements.
You save the difference.
Eight different types will measure the finest wire up to and including 3-inch cable.
All equipped with "VISIBLE" counters.

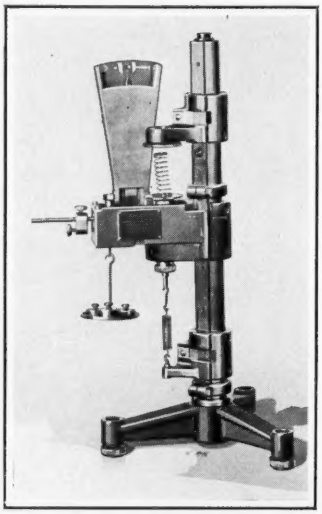
Manufactured by
HOPE NARROW FABRIC CO.
68 Althea St., Providence, R. I.
Builders of Improved Braiding Equipment for more than 25 Years.

by the outer braiding is removed from the cord a certain predetermined distance back from the stripped conductors.

✦ ✦ ✦

Testing Apparatus for Light Springs

FOR accurate extension or compression tests and quick inspection of light springs, the Coats Machine Tool Co., 110 West Fortieth Street, New York, has placed on the market a new loose-weight and pendulum indicating spring testing machine designated as the type RS "elasticometer". Maximum capacities are: load, 5 lb.; open length of compression springs, 6¼ in.; extended length of compression springs, 8⅝ in.; spring diameter, 1¾ in.



A scale ratio of 1:1 is provided by the single lever or beam mounted on knife edges of the same design as used on spring testing machines. From the outer end of this beam is suspended a weight pan; the other end supports a bar, guided by steel balls and carrying a compression plate or platform at the upper end and a tension hook below. The indicator pointer is directly attached to the beam.

Tension and compression tests are made by means of slides on the pillar of the instrument. Vertical scales on the pillar and verniers on the slides permit accurate measurement of the amount of ex-

pansion or compression. Adjustable stops limit the motion of the slides for quantity inspection.

To facilitate inspection of the free, compressed or extended length of springs, there are tolerance indicators arranged to slide along a groove adjacent to the scale on the pillar. Other tolerance markers, located on the indicator scale, may be set to the limits of spring tension or compression required. Although designed for a normal load of 5 lb., the machine, when supplied with a longer weight carrier, may be used for compression loads up to 11 lb.

The instrument is 20 in. high and weighs 27 lb.

✦ ✦ ✦

The Gilbert and Bennett Manufacturing Co., of Georgetown, Conn., recently announced an expansion of its business.

Two additional lines of fly wire cloth will be manufactured at the plant.

The company continues its fine lines of pearl, copper and bronze and in addition add electric galvanized and black painted, the latter two being popular price goods which are used in large quantities, and distributed by the same jobbers who handle all its other lines of goods.

Machinery is being added, idle machinery restored to use and more people employed as a result of the expansion.

✦ ✦ ✦

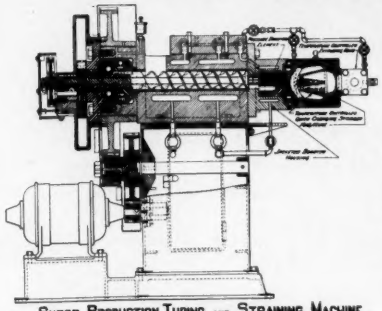
The Brown Instrument Company, 4494 Wayne Avenue, Philadelphia, Pa., has just issued a new publication explaining and illustrating the principal features of their new potentiometer pyrometer with special reference to accuracy of operation and ruggedness in service.

A copy of this booklet may be obtained upon request.

✦ ✦ ✦

FOR INFORMATION REGARDING
THE WIRE ASSOCIATION
ADDRESS
RICHARD E. BROWN,
SECRETARY,
551-5th AVE., NEW YORK, N. Y.

Of Vital Interest to Insulated Wire Industry

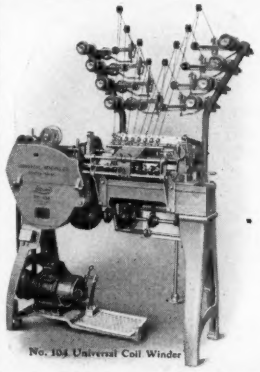


SUPER PRODUCTION TUBING AND STRAINING MACHINE

A positive and thoroughly proven advance in extruding efficiency that no user of tubing and straining machines, regardless of size, can afford to overlook.
Tremendous reductions in insulating costs by more than doubling speed of production, and additional reductions by combining straining with the tubing operation.

For Detailed Information Address
Corone Wire Insulators, Inc.
PUTNAM, CONN.

ROCKWELL
FURNACES
ELECTRIC *and* FUEL
For Ferrous and Non-Ferrous Wire Products
Complete heating equipment for strand annealing, billet heating and intermediate operations.
Bright annealing furnaces for ferrous and non-ferrous metals.
"Furnace and Fuel to Suit Conditions"
ELECTRICITY—GAS—OIL—COAL
W. S. ROCKWELL COMPANY
Industrial Heating Equipment
1885-1 50 Church Street (Hudson Terminal Building) New York



No. 104 Universal Coil Winder

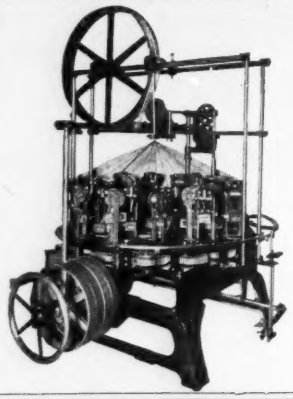
An interesting development for more efficiently producing paper-insulated coils. Paper is injected automatically without attention from the operator. Fully adjustable for a wide range of coil and wire sizes.

Six other machine types complete a line of coil winders answering any possible manufacturing need.

Catalog is available on request.

UNIVERSAL WINDING COMPANY
BOSTON
LEESONA

WIRE DRAWING
Machinery and Equipment
Rod Frames—16" Frames
8" Frames—Take-Up Frames
Wire Pointers—Puller Tongs
General Castings for Wire Mill Use
Circulars on Request.
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON N. J.



WIRE BRAIDERS

Multiple Head Wire Covering Braiders

Single, Double or Triple Deck Wire Covering Braiders

Single, Double or Triple Deck Cable Braiders

FIDELITY MACHINE COMPANY

Philadelphia, Pa.

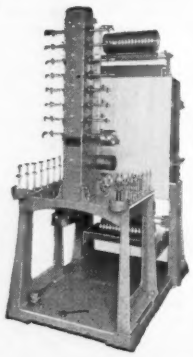
WIRE BUNCHING MACHINES
WIRE STRANDING MACHINES
TWINNING MACHINES Up to And Including
SEVEN CONDUCTORS

(Manufactured under the Dawes Patents)

HASKELL-DAWES MACHINE CO., INC.

Ontario St. Below Trenton Ave.,
Philadelphia, Pa.

(4)



AIMCO R-16 MODEL
WIRE ENAMELING MACHINE

Enamels Wire 36 B. & S. Gauge and Finer.
Electrically Heated Oven with Thermostatic Control.
Finished Wire Spindles Individually Controlled.
Traverse is Adjustable for Different Spool Dimensions.
Low Cost of Enameling Wire is Due to Ease of Operation and Number of Spindles one Operator can tend.
Self-Contained on Bed-Plate.
Motor Driven.
Motor included.

EST. 1855 AIMCo INC. 1918
"American" INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
517 Huntingdon St.
Philadelphia, Pa., U. S. A.

Heater Cord Testing Machines
Built To Underwriters Specifications

NEW ENGLAND BUTT COMPANY

Office and Factory
304 Pearl St., Providence, R. I.

Western Office
20 North Wacker Drive, Chicago, Ill.

We build a complete line of Stranding Machines, Cabling Machines, Closing Machines, Rubber Strip Covering Machines, Measuring Machines, and Other Allied Machines for the Wire Trade.

OUR WIRE MACHINERY CATALOGUE SENT ON REQUEST

'Round the World With the Wire Industry

(*Continued from page 444*)

fits were halved—amounting to but £83,257 in the subject year against £161,889 in 1929-30. The effect of prevailing unsatisfactory economic conditions in Australia as reflected in the reduction in demand for the iron and steel products made by this company is clearly indicated by the following figures taken from the report:

	Year Ended May 31		
	1929	1930	1931
Pig iron, tons	330,805	187,517	185,680
	1929	1930	1931
Steel ingots, tons	374,059	265,929	210,146

✦ ✦ ✦

Protection for Wire Nails in India

THE Indian Steel & Wire Products, Taga-nagar, appeared before the Tariff Board recently and aksed for the restoration of protection for the wire and wire-nail industry. The company demanded protection for ten years in the form of a duty of Rc. 80 (£6) per ton for the first five years in addition to a bounty of Rc. 40 (£3) per ton for the first two years, and a duty of Rs. 60 (£4 10s.) per ton for the next three years, and Rs. 40 (£3) per ton for the last two years, on all sections of wires, wire nails, barbed wires, fencing, stranded wire, G. I. wires and twisted chains. The bounty of Rs. 40 per ton is meant to cover the losses incurred during the last four years.

The company has also asked for a protective duty of Rs. 45 (£3 7s. 6d) per ton on wire rods and bars below ½-inch section and strips up to ¾ inch wide. They complained of dumping from foreign countries and were ready to give a guarantee of a fixed fair selling price which might be stipulated by legislation. It is contended that past experience would enable the industry to stand on its own legs in due course.

The Tata Iron & Steel Company in their evidence stated that the wire-nail industry should be en-

couraged, but at the same time pointed out that there was no prospect of their being able to roll wire rods in the near future.

✦ ✦ ✦

Future Quotations of Continental Wire Producers in American Dollars

The depreciation of the British pound sterling has caused the continental steel wire producers to quote in future only offers in American dollars. The first prices heard after the continental wire makers have changed into dollar quotations were as follows: wire nails, basis $24.50, nail wire, bright 24.-barbed wire BWG 12 $42.—galvanized wire basis $31. —annealed wire $26.50 varnished wire 30.—Wire netting is still sold at pound sterling rates by discount off the British standard list, but on condition that the difference between the gold and paper pound is added. The situation on the continental steel wire export market has been aggravated by the circumstance, that a number of Belgian steel wire works are refusing to execute the old orders which were booked in pound sterling, the customer does not pay the difference between the paper and gold pound.

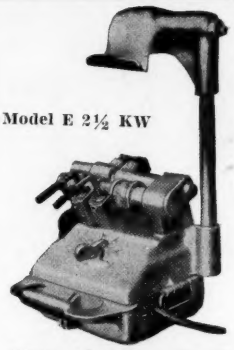
✦ ✦ ✦

The cartel of hexagonal wire netting manufacturers now controls the export Trade with all Overseas markets and also Great Britain and Scandinavia. The price is now only 89½% off the British standard list f. o. b.

✦ ✦ ✦

"Engineering Electric Trucks to Fit Your Job", is the title of a booklet just published by the Elwell-Parker Electric Company, 4000 St. Clair Ave., Cleveland, Ohio. This booklet describes and pictures various applications of electric trucks as designed for special handling jobs and is illustrated with over 60 photographs of difficult work.

The booklet contains many valuable ideas and a copy may be obtained by writing for it.


Model E 2½ KW

Welds wires from No. 20 to No. 4

Wire and Rod Welding

Better -- Faster -- at Less Cost

Spot Welders—Butt Welders

Various Models With Capacities From No. 20 wire to ⅝" Rods—For All Metals—

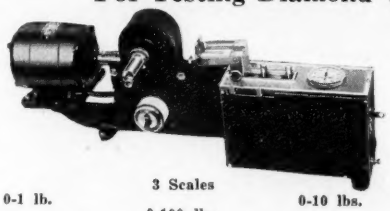
Write for full details of our various models, and tell us something of your needs.

MICRO PRODUCTS COMPANY

140 Industrial St. Dept. 531 Peoria, Ill.

European Office, H. A. Schlatter & Co.
Zurich, 1, Limmatquai 32, Switzerland.

For Testing Diamond Wire Drawing Dies


3 Scales

0-1 lb. 0-10 lbs. 0-100 lbs.

Length 25" Height 8½" Weight 38 lbs.

THE

"Triplex" Dynamometer

Accurately indicates the traction required to draw wire. May be set so that indicator hand remains at maximum reading, allowing ultimate break tests to be made.

We will place this dynamometer on trial in your plant upon request.

Your Inquiries Solicited

ROBERT MILLER

221 NORTH 23d ST., PHILADELPHIA, PA.

DIAMOND DIES

When purchasing
Diamond Dies
avail yourself of the
forty years' experience
of the famous

P-H-I-L-I-P-S W-O-R-K-S

Any inquiries will be dealt with promptly

RAW MATERIAL DEPARTMENT

PHILIPS LAMP WORKS

EINDHOVEN HOLLAND

BALLOFFET

1870 — 1931

The Quality Diamond Dies

Balloffet Diamond Wire Dies Co., Inc.

13-15 East 22nd St., New York City

PLANTS AT

New York Lagnieu (France) Cluses (France)
Trevoux (France)

DETROIT WIRE DIE COMPANY

DIAMOND AND TUNGSTEN CARBIDE
DIES FOR WIRE DRAWING

We manufacture our complete diamond dies in this country from the very finest diamonds that are obtainable. We have made a study of wire drawing problems and manufacture the dies to fit your problems.

WE WOULD APPRECIATE AN OPPORTUNITY
TO SERVE YOU

Detroit Wire Die Company 6106 Linwood Avenue, Detroit, Mich.

VIANNEY

DIAMOND
DIES

100 FIFTH AVE · NEW YORK

"The House of Service"

Bellet Diamond Die Works

Manufacturers of

DIAMOND DIES
and
COMPOSITION DIES

Factories { Trevoux—France
New York, N. Y.

New York Office 315 Fifth Ave.

TWENTY acres of reinforcing mesh will go into the concrete slabs to be used for the floors and roofs of the ten great building units in the Rockefeller mid-town construction project popularly known as "Radio City." The contract for this material was awarded to the American Steel & Wire Company.

The order covers all varieties and sizes of wire reinforcing fabric, including electric weld and triangle mesh fabric, to be used in the entire development. The weight of the mesh will be more than 3,000 tons.

✦ ✦ ✦

The Page Steel & Wire Company has opened a southeastern district sales office with headquarters at 1520 Healey Building, Atlanta, Georgia. This new office will be in charge of R. J. Teeple.

Mr. Teeple has been connected with the fence department of the Page Steel & Wire Company for the past ten years, and has been in charge of the chain link fence division for the past three years.

The Waterbury Wire Die Co.

Diamond, Composition
and
CHILLED IRON DIES
Waterbury, Conn.

Corrosion Tests For Non-Ferrous Metals and Alloys

A. S. T. M. Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys has sponsored the preparation and distribution of 16,000 specimens of many different materials. These will be exposed in nine outdoor test locations and in four different liquid immersion test locations for exposure tests. All specimens have now been placed on the racks at the following test sites:

Test Sites	Types of Atmosphere
1. Pittsburgh, Pa.	Industrial
2. Altoona, Pa.	Industrial
3. State College, Pa.	Rural
4. New York City	Combination of semi-industrial and partial seacoast exposures
5. Sandy Hook, N. J.	Northern seacoast
6. Rochester, N. Y.	High humidity, light industrial
7. Key West, Fla.	Southern seacoast
8. Phoenix, Ariz.	Dry inland
9. San Diego (La Jolla), Calif.	High humidity, seacoast

The committee plans to review data which was obtained on accelerated corrosion tests and to write recommended practice instructions for total immersion, alternate immersion, spray and accelerated electrolytic tests together with a critical review of each. This data, once it is published, should be of great value to the industries whose products are affected by corrosive action.

Mr. Sam Tour, Vice-President, Lucius Pitkin, Inc., New York City, is secretary of the committee.

+ + +

The Next Article in The Discussion, Electro Galvanizing vs. Hot Galvanizing, Will Appear in the December Issue of WIRE and WIRE PRODUCTS.

Diamant-Drawing Stones

Almost New

made of the best material, 80-250 microns.

Ex stock, at $2.50 each, postage and packing extra; if set, $0.25 more.

N. V. Philips' Gloeilampenfabrieken

Raw Material Dept.

EINDHOVEN, (HOLLAND)

MASTER Tungsten Carbide Drawing Dies
for **Wire, Rod, Tubing and Specialties**

Made by patented precision machinery insuring exact shape duplication. Lower production costs decrease rejections

Master Wire Die Corporation

Main Office and Plant: 408 CONCORD AVE., NEW YORK

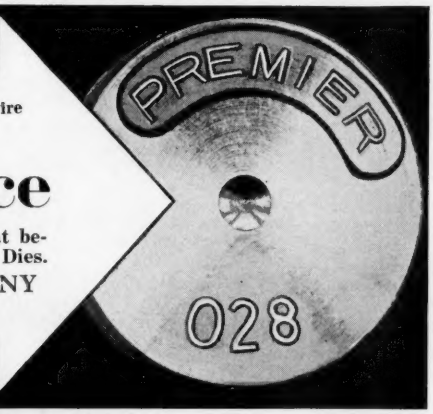
1411 Brighton Road, Pittsburgh, Pa. 1658 St. Clair Ave., Cleveland, O.

The results you get in drawing wire depend upon the

Experience

of your die maker—we learned that before we made "Premier" Diamond Dies.

DRIVER-HARRIS COMPANY
HARRISON, N. J.



BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

ANNEALING FURNACES
See Furnaces—Various Headings

ANNEALING POTS
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

BOBBINS
Mossberg Pressed Steel Co., Attleboro, Mass.

BRAIDER CARRIERS
Mossberg Pressed Steel Co., Attleboro, Mass.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CLEANING & PICKLING EQUIPMENT
Vaughn Machinery Co., Cuyahoga Falls, O.

COILERS—Sheet and Wire
H. J. Ruesch Machine Co., Newark, N. J.

COMPOUNDS—Insulating
Corone Wire Insulators, Inc., Putnam, Conn.

COMPOUNDS—Wire Drawing
Oak Chemical Co. Bechtelsville, Pa.

COPHOLDERS
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIE TESTING DYNAMOMETER—To Indicate Traction Required To Draw Wire
Robert Miller, Philadelphia, Pa.

DIES—Chilled Iron
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Composition
Addor Wire Die Works, N. Y.
Bellet Diamond Die Works, N. Y.
F. Krause, Inc., Jersey City, N. J.
Urdika Wire Die Works, Inc., New York
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
Addor Wire Die Works, N. Y.
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Bellet Diamond Die Works, N. Y.
Cochaud Wire Die Co., New York.
Detroit Wire Die Co., Detroit, Mich.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Master Wire Die Corp., New York, N. Y.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Addor Wire Die Works, N. Y.
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Bellet Diamond Die Works, N. Y.
Cochaud Wire Die Corp., New York.
Detroit Wire Die Co., Detroit, Mich.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Wm. Haddow, Ossining, N. Y.
F. Krause, Inc., Jersey City, N. J.
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Master Wire Die Corp., N. Y.
Union Wire Die Corp., N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Bellet Diamond Die Works, N. Y.
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Master Wire Die Corp., New York, N. Y.
Union Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

FURNACES—Annealing
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

FURNACES—Automatic
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

FURNACES—Bright Annealing
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

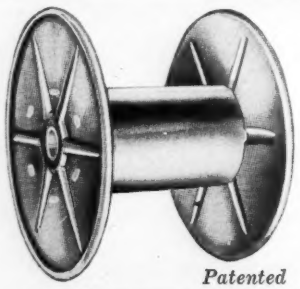
FURNACES—Electric
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

FURNACES—Lead Melting
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

FURNACES—Wire
Chas. F. Kenworthy, Inc., Waterbury, Conn.
W. S. Rockwell Co., New York, N. Y.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.



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MOSSBERG
Reels and Spools
Made of Pressed Steel

A complete line of reels and spools for every phase of manufacturing, handling and shipping. They are practically indestructible. Send for catalog of stock designs or for quotation on your own specifications.

Above: a curled flange, pressed steel spool for handling and shipping. Pressed-in radial ribs give added strength. Barrels are provided with our patented rib filler.

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Makers of "Mosspeed" Braider Carriers.

Bethlehem Steel Co., Bethlehem, Pa., has announced the acquisition of the Kalman Steel Co., Chicago, fabricator and distributor of reinforcing steel, wire fabric and metal lath. The acquired company is to be known as the Kalman Steel Corp., offices at Bethlehem, Pa.

The new corporation will have the following as general officers with headquarters in Bethlehem: Paul Mackall, president; George E. Routh, Jr., vice president in charge of sales; Quincy Bent, vice president in charge of operations; R. E. McMath, vice president and secretary; Robert Young, treasurer; F. A. Shick, comptroller; and Charles R. Holton, purchasing agent.

✦ ✦ ✦

A history of the development of wire drawing, by Kenneth Lewis will start in the December Issue of Wire and Wire Products —Mr. Lewis describes processes, machinery, etc. in complete detail.

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Specializing in Galvanizing Plants Designed and Installed
Practical Engineering Advice
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also Composition Dies

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[Originators of the Steel Setting]
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JERSEY CITY, N. J.

BUYERS' GUIDE, Continued

INHIBITORS—
Wm. M. Parkin & Co., Pittsburgh, Pa.

INSULATING COMPOUNDS
Corone Wire Insulators, Inc., Putnam, Conn.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller & Co., Homer, N. Y.
Oak Chemical Co., Bechtelsville, Pa.
J. T. Robertson Co., Syracuse, N. Y.

MACHINE—Die Re-cutting and Polishing
Wm. Haddow, Ossining, N. Y.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Phila., Pa.
Hope Narrow Fabric Co., Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt. Co., Providence, R. I.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
Haskell-Dawes Machine Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
Haskell-Dawes Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Paper Insulated Coils
Universal Winding Co., Providence, R. I.

MACHINERY—Coil Winding
Amer. Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Universal Winding Co., Providence, R. I.

MACHINERY—Coiling
Broden Const. Co., Cleveland, O.
Haskell-Dawes Mach. Co., Phila., Pa.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrell Fdry & Machine Co., Waterbury, Conn.

MACHINERY—Cutting
American Insulating Mach'y Co., Phila., Pa.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing Wire
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
Corone Wire Insulators, Inc., Putnam, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Measuring Wire & Cable
Hope Narrow Fabric Co., Providence, R. I.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rivet
Waterbury-Farrell Fdry & Machine Co.,

MACHINERY—Rod
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrell Fdry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Strip Covering
American Ins. Mach'y Co., Phila., Pa.
Corone Wire Insulators, Inc., Putnam, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Corone Wire Insulators, Inc., Putman, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
Fred'k M. Conran, Newark, N. J.
American Insulating Machinery Co., Phila.
Hope Narrow Fabric Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
American Insulating Mach'y Co., Phila Pa.
Fred'k M. Conran, Newark, N. J.
Haskell-Dawes Machine Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

Wire Drawing Diamond Dies

COCHAUD
WIRE DIE CORPORATION
300 W. 56th ST., NEW YORK
Tel. Col. 5-1340

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All cases submitted given personal attention by members of the firm. Information and booklet free.

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PATENT LAW OFFICES
Suite 438, 815-15th St., N.W. Washington, D. C.

BUYERS' GUIDE, Continued

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.
Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Company, Paterson, N. J.

MACHINERY—Testing Die Traction
Robert Miller, Philadelphia, Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrell Fdry. & Machine Co., Waterbury, Conn.

MACHINERY—Welding Wire
Micro Products Co., Peoria, Ill.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Universal Winding Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

POINTERS—Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.
J. T. Robertson Co., Syracuse, N. Y.

SOLDER—Silver
Handy & Harman, N. Y.

SPOOLS—Annealing—Detachable Head Handling—Wire Stitching
Mossberg Pressed Steel Corp., Attleboro, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WIRE—Various Kinds
Hudson Wire Co., Ossining, N. Y.

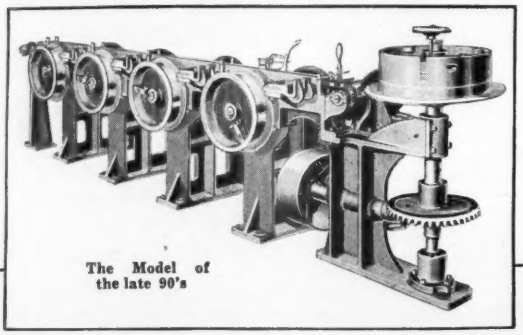
This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

WATERBURY-FARREL TANDEMS

Three Decades Perfecting Continuous Wire Drawing Machines

We thought the old machines were pretty good in the old days (and they were) but times have changed. Today we offer not a better method nor a new principle, but—a far better machine that meets in eloquent fashion every demand of the present day—

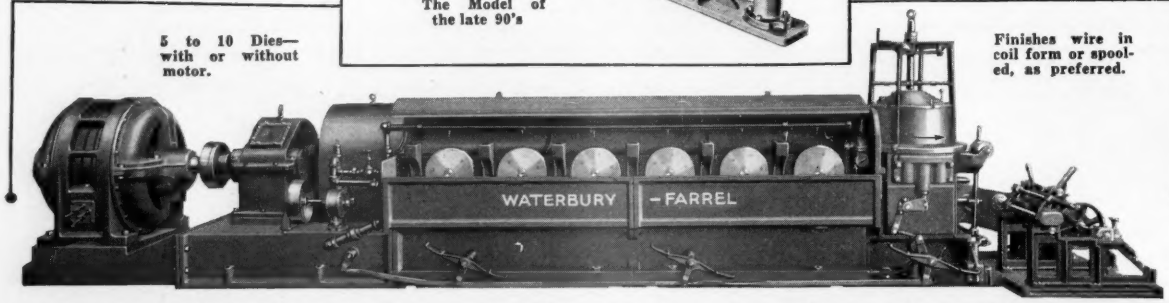
High Speed
Low Operating Cost
Mechanical Efficiency



The Model of the late 90's

5 to 10 Dies—with or without motor.

Finishes wire in coil form or spooled, as preferred.



No. 1 Machine. Forced feed lubrication. Ball Bearings throughout. Starting size, 5/16" copper rod.

The Waterbury Farrel Foundry and Machine Company

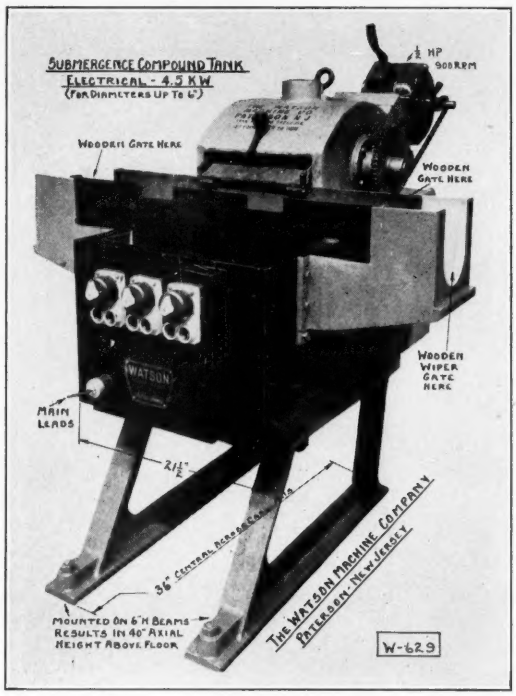
Home Office and Works: Waterbury, Connecticut
Western Offices: 736 Bulkley Bldg., Cleveland, Ohio, and Daily News Bldg., Chicago, Ill.

THE WATSON MACHINE COMPANY

PATERSON, NEW JERSEY, U. S. A.

Electrical Wire and Cable, Wire Rope and Cordage Machinery

SUBMERGENCE COMPOUND TANKS — Steam and Electrically Heated



For Cable diameters up to 6".

Cut W-629 shows Electrically Heated Unit.

We also manufacture Steam Heated Tanks having side, end and bottom jackets for pressures up to 150 lbs. All one piece tank casting eliminates steam jacket joint leakage possibility.

Each Steam Tank has two tapped bosses for insertion of Immersion Type Electrical Heaters to obtain temperatures above that of the steam.

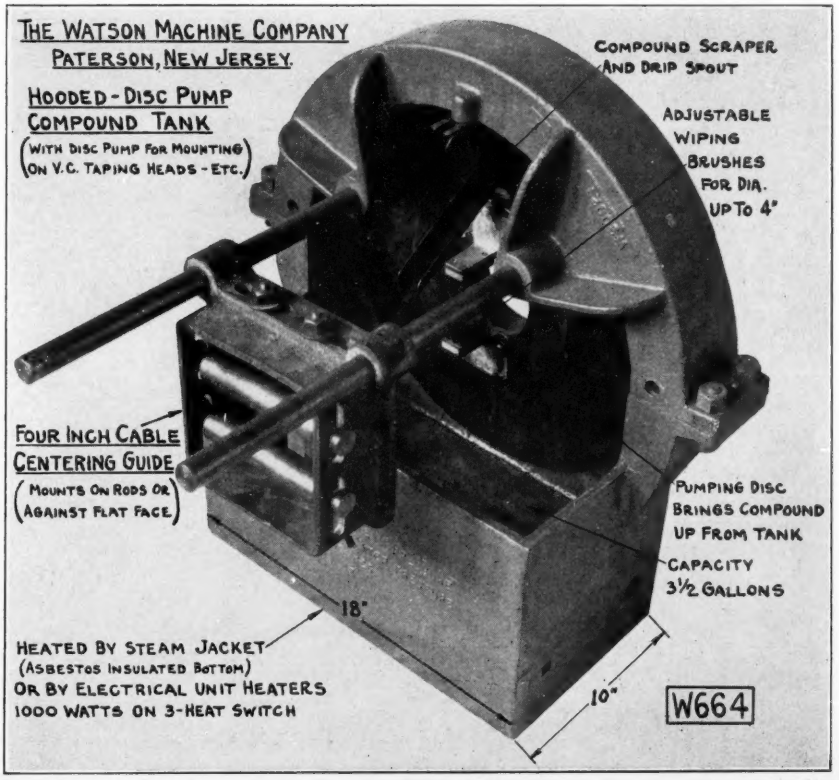
Constant flow of hot compound insured by each tank having motor driven pump.

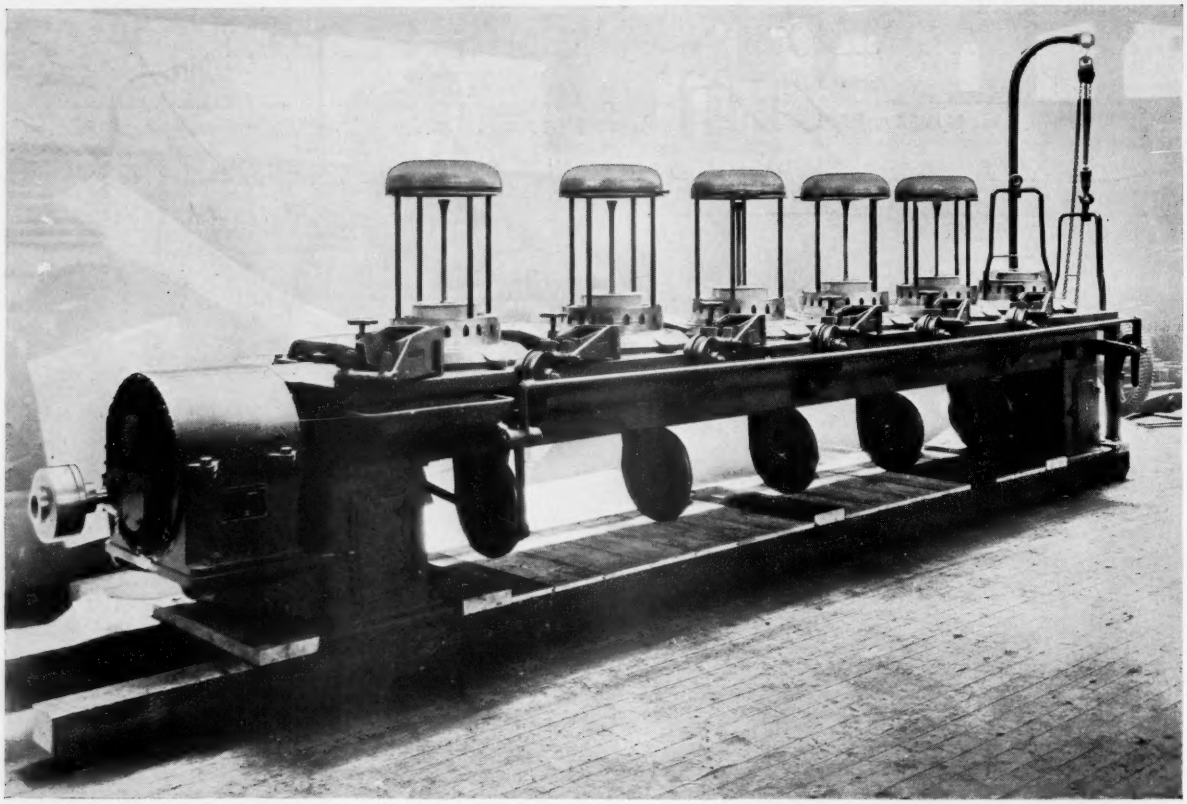
This tank was designed primarily for use on Taping Machines but has had considerable other applications.

The Tank is provided for heating by steam (pressures up to 150 lbs.); or by electrical unit heaters (1000 watts) on a 3-heat switch. Thermometer well is provided in the tank.

In applications on Taping Machines, the pump disc is mounted directly on and rotates as part of the Taping Head Center Shaft. Where used as entirely separate unit, we provide a ¼ H. P. single phase motor mounted directly on the hood, this driving the pumping disc.

Write for complete descriptions and bulletins on these machines.


THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY.
HOODED-DISC PUMP COMPOUND TANK
(WITH DISC PUMP FOR MOUNTING ON V.C. TAPING HEADS - ETC.)
COMPOUND SCRAPER AND DRIP SPOUT
ADJUSTABLE WIPING BRUSHES FOR DIA. UP TO 4"
FOUR INCH CABLE CENTERING GUIDE
(MOUNTS ON RODS OR AGAINST FLAT FACE)
PUMPING DISC BRINGS COMPOUND UP FROM TANK
CAPACITY 3½ GALLONS
18"
10"
HEATED BY STEAM JACKET
(ASBESTOS INSULATED BOTTOM)
OR BY ELECTRICAL UNIT HEATERS
1000 WATTS ON 3-HEAT SWITCH
W664



Morgan-Connor Wire Machines are producing rope wire to A. P. I. specifications.

MORGAN CONSTRUCTION COMPANY
WORCESTER, MASSACHUSETTS

MALMEDIE & COMPANY, Dusseldorf, Germany
Sole Licensee for Morgan-Connor Wire Machines in Europe

MORGAN
WORCESTER

Engineers and Manufacturers